EVALUATING LATERAL CEPHALOMETRIC X-RAY FILMS

. Obtaining a lateral cephalometric x-ray film is a standard practice in orthodontic diagnosis.
. Orthodontists do not “treat to a number”.
. Information obtained from a “lateral cephi” provides only a part of the diagnostic puzzle.

WHAT ORTHODONTISTS USUALLY IGNORE ON LATERAL CEPHS

. When orthodontists evaluate lateral head x-rays (lateral cephs), their focus is on the jaws and dentition.
. What is going on past the third molars is not usually taught or emphasized in orthodontic residency programs (that is: details about the status of the cervical spine, cranial base angulation, the adenoid mass, and soft palate functions).
. I hope that when you return home, you will ask your orthodontic referral sources for a full-size copy of the lateral cephs taken on all mutual patients.
. I hope that you will routinely trace and measure the adenoid mass, soft palate, cranial base angle and selected features of the cervical spine. This process will distinguish you among others competing for referrals from orthodontists.

WHAT YOU WILL LEARN IN THIS SEGMENT

. Your evaluation of structures beyond the third molars will occasionally reveal findings that could negatively impact those patients.
. Your evaluation of structures beyond the third molars will also serve to document characteristics of patients with OMDs that have not yet been reported.
. I intend to teach you how to evaluate the adenoid mass, cervical spine, cranial base angle, and soft palate functions.
. You will achieve expertise beyond what is taught in residency programs in orthodontics.
THE EQUIPMENT:
ORTHODONTIC LATERAL CEPH UNITS
STANDARDIZED DISTANCE

PATIENT POSITIONED IN HEADHOLDER
(CEPHALOSTAT)
(FROM BATEMAN AND MASON ANATOMY AND PHYSIOLOGY TEXT, 1986)

CEPHALOMETRIC LANDMARKS AND LINE ANGLES
OF SPECIAL INTEREST TO ORTHODONTISTS
(SEE THE FORM PROVIDED)
THE VALUE OF A LATERAL CEPH
AN EXAMPLE OF PSEUDOPROGNATHISM:
IN SPITE OF THE CLINICAL APPEARANCE OF A LARGE MANDIBLE, THE LATERAL X-RAY FILM
TRACING SHOWS THIS TO BE A NORMAL MANDIBLE AND A RETRUDED MAXILLA.

THE VALUE OF A LATERAL CEPH:
PLANNING FOR ORTHOGNATHIC SURGERY
(A PATIENT EXAMPLE OF VERTICAL MAXILLARY EXCESS AND
LIP INCOMPETENCE)

NOTE THE MENTALIS MUSCLE STRAIN
WITH LIPS TOGETHER
RIGHT LATERAL VIEW OF DENTITION

VERTICAL MAXILLARY EXCESS – MORE POSTERIORLY THAN ANTERIORLY
SOME KEY CEPH FINDINGS

CEPH PREDICTION:
SOME KEY ITEMS, AND ROLES ASSUMED
(IN SURGICAL PLANNING, THE ORTHODONTIST IS THE ARCHITECT
AND THE SURGEON IS THE CONSTRUCTION COMPANY)

6 MONTHS OF ORTHODONTIC LEVELLING OF THE
DENTITION
PRE-SURGICAL ORTHODONTIC PREPARATION

SURGICAL CUTS FOR MAXILLARY IMPACTION
(OR SUPERIOR REPOSITIONING OF MAXILLA)

TRACING OF CEPH SUPERIMPOSITIONS:
PREDICTION AND SURGICAL RESULT
SURGICAL VIEW OF ADVANCEMENT GENIOPLASTY

POST-SURGERY STABILIZATION WITH ELASTICS

COMPLETED DENTITION
RIGHT LATERAL VIEW OF COMPLETED DENTITION

PRE AND POST-OP CEPHS

REST PRE-TREATMENT, AND SMILE POST-TREATMENT
POST-OP FULL SMILE

LIP INCOMPETENCE PERSISTED AFTER SURGERY
MYOFUNCTIONAL MUSCLE RESISTANCE EXERCISES WERE USED TO ACHIEVE A NORMAL REST POSTURE OF THE LIPS

10 YEAR OLD WITH CLEFT LIP AND PALATE AND SEVERE MAXILLARY RETRUSION WHO WAS ABANDONED BY HER MOTHER AND RAISED BY HER GRANDMOTHER
MAXILLARY ADVANCEMENT PLANNED
ORTHODONTICS FIRST, THEN MAXILLARY ADVANCEMENT SURGERY:
BEFORE AND AFTER

STORIES TO BE TOLD BEYOND THE THIRD MOLARS:
INFORMATION YOU CAN USE IN YOUR CLINICAL PRACTICE

- Cranial base angle variations and clinical implications
- The “effective length of the velum
- The adenoid mass as a contact site for velopharyngeal closure
- The cervical spine
- (The information to follow is not included in the training of most orthodontists)

CRANIAL BASE ANGLE
ARE THERE CLINICAL IMPLICATIONS?
THE CLINICAL IMPLICATION OF CRANIAL BASE ANGLE VARIATIONS
(NOTE: AN OBTUSE CRANIAL BASE IS ALSO REFERRED TO AS PLATYBASIA)

OBTUSE CRANIAL BASE ANGLE AND DEEP PHARYNX MASKED
BY ADENOID PAD
QUESTION: WHAT WILL HAPPEN IF THE ADENOIDS ARE
SURGICALLY REMOVED?

OBTUSE CRANIAL BASE ANGLE AND
DEEP PHARYNGEAL DEPTH
THE PREDICTIVE VALUE OF MEASURING THE CRANIAL BASE ANGLE

- If you measure an obtuse cranial base angle and determine that a total adenoidectomy would result in persistent hypernasality, you should alert the treating orthodontist and ENT or allergy resource about your predictive finding.
- A follow-up lateral ceph taken during a sustained phonation is indicated.
- A “lateral”, or “peritubal” adenoidectomy can be done that leaves the midline adenoid mass to preserve velopharyngeal closure.

ACUTE CRANIAL BASE ANGLE AND LARGE ADENOIDS

BASIC INSIGHTS ABOUT THE ELEVATED VELUM
NORMAL (LEFT) AND TOUCH CLOSURE (RIGHT)

THE SOFT PALATE – IMPORTANT CONCEPT: THE “EFFECTIVE LENGTH” OF THE VELUM

VELUM AT REST, LARGE ADENOID MASS, AND OBTUSE CRANIAL BASE ANGLE
WHAT DO YOU PREDICT ABOUT VELOPHARYNGEAL CLOSURE?
WHAT IS YOUR PREDICATION ABOUT SPEECH IF A TOTAL ADENOIDECTOMY IS PERFORMED?

A CANDIDATE FOR ADENOIDECTOMY?

- This patient may become persistently hypernasal if a total adenoidectomy is done. The ENT specialist should be alerted to your observations and measurement prediction.
- Are there any intraoral contraindications as well? (Be sure to look)
- (An article is provided with reminders of how to prevent hypernasality by preoperative evaluation)

A CLINICAL APPLICATION:
MONOZYGOTIC TWIN GIRLS
(DONNA HAD A TOTAL ADENOIDECTOMY FOLLOWED BY PERSISTENT HYPERNASALITY)
ANOTHER CLINICAL APPLICATION
MOTHER AND 3 CHILDREN WHO PRESENTED AT CLINIC
(THE PROPOSITUS IS AT THE BOTTOM LEFT)

CEPH TRACINGS (TAKEN DURING SUSTAINED PHONATION OF /U/)
OF MOTHER AND 2 CHILDREN WITH SUBMUCOUS CLEFTS

SUMMARY: COMPARISONS OF NORMAL (LEFT)
AND SUBMUCOUS CLEFT (RIGHT)
DURING SUSTAINED PHONATION
NORMAL CERVICAL SPINE
“THE RULE OF THREES”
PLUS A “PENCIL WIDTH” AT OCCIPITAL CONDYLES

THE NORMAL 3 MM DISTANCE RELATIONSHIP OF
THE LIGAMENT CONNECTING BASION AND THE DENS

(Note: The ligament is often calcified and can give the
appearance of basion resting on the odontoid)

UNIQUE CHARACTERISTICS OF
FIRST AND SECOND
CERVICAL VERTEBRAE
THE TRANSVERSE LIGAMENTS THAT SUPPORT THE ADI AND PROTECT THE SPINAL CORD FROM DAMAGE

THE ATLAS-DENS INTERVAL (ADI)

McRae (1953) found that when the odontoid process moved back and forth more than 3 mm on flexion and extension of the head, neurologic signs were always present.

Atlanto-Axial Relations:

Adult male: 2.05 mm, - 0.02 x age in years ± 1.00 mm.

Adult female: 1.24 – 0.0074 x age in years ± 0.90 mm.

Children ages 3-15, male and female, if greater than 4 mm in the neutral position, subluxation (dislocation) should be suspected.

THE DENS - SHOWING THE SYNOVIAL MEMBRANES ON THE MESIAL AND DISTAL SURFACES
THE ADI: CLINICAL RULE OF THUMB

- On a lateral cephalogram, evaluate the distance between the distal (back) surface of the anterior arch of the atlas to the mesial (front) surface of the odontoid process (dens).
- The normal ADI is 3 mm or less.
- If this distance is found to be 5 mm or more, a referral to a radiologist is indicated.
- Reminder: a 4 mm ADI may suggest a subluxation (dislocation) of the odontoid (dens)

WHY THE ADI MAY BE WIDER THAN NORMAL:
A CHILD OR ADULT WITH A HISTORY OF PREVIOUS TRAUMA, SUCH AS FROM AN AUTO ACCIDENT

HERE'S ANOTHER LOOK AT THE ADI FROM THE LATERAL DIMENSION
A REMINDER ARTICLE IS PROVIDED (MASON, THE PHARYNX IN CLEFTS)
WHAT SHOULD YOU DO IF YOU FIND AN ADI THAT IS OVER THE NORMAL 3 MM?

● First, if you would like my help interpreting your findings, please copy the radiograph and send it to me at oitsbob@sc.rr.com for my opinion. I offer this free diagnostic service to all of you taking this course.

● You should share this information with the orthodontist and recommend that additional cephs to be taken during both flexion and extension of the head.

● If the ADI is confirmed to be large and if the odontoid appears to be impinging against the spinal cord, referral to a radiologist (by you and the orthodontist) is indicated.

HOW RADIOLOGISTS EVALUATE THE VERTICAL RELATIONSHIP OF THE DENS (ODONTOID) TO THE FORAMEN MAGNUM

● You will recall that there should be ≥3 mm vertical distance between basion and the tip of the dens.

● Several physicians (apparently in need of publications for promotion) have published articles recommending various line measurements to evaluate the upper cervical vertebrae in relationship to the base of the skull.

● These physicians are: Chamberlain, McGregor, and McRae.

CHAMBERLAIN'S, McGREGOR'S AND McRAE'S LINES (USED TO DESCRIBE THE POSITION OF THE DENS TO THE FORAMEN MAGNUM)

● Chamberlain's line runs from the posterior nasal spine of the hard palate (PNS) to the middle of opisthion.

● McGregor's line extends from the PNS to the bottom of opisthion.

● McRae's line runs from near the bottom of the clivus (just above opisthion) to basion.
THE VARIOUS LINES
(THAT RADIOLOGISTS WOULD KNOW)

TERMINOLOGY CONFUSION THAT CONTINUES
IN THE MEDICAL LITERATURE:
BASILAR INVAGINATION, AND BASILAR IMPRESSION

The terms basilar invagination and basilar impression are often used interchangeably because in both cases there is upwards migration of the upper cervical spine, but, they are not synonyms.

**Basilar invagination** is defined as the upward displacement of vertebral elements into the normal foramen magnum with normal bone, while **basilar impression** is a similar displacement due to softening of bones at the base of the skull.

(from Radiopaedia.org)

FLATTENED ANTERIOR TUBERCLE OF ATLAS AND SHORT EFFECTIVE LENGTH OF VELUM
(X-RAY TAKEN DURING SUSTAINED PHONATION)
THIS CONDITION IS VERY IMPORTANT TO IDENTIFY

WHAT I HOPE YOU WILL DO WITH THIS INFORMATION: THE CERVICAL SPINE

During your clinical lifetime, if you identify one patient whose odontoid extends into the foramen magnum (basilar invagination), you may have saved that person from being paralyzed from the neck down.

Any intrusion of the odontoid into the foramen magnum should be referred to a radiologist for definitive evaluation and counseling of the patient who should not participate in contact sports or even gym class.

Also, if any surgery is planned, the anesthetist should be advised not to extend the head excessively during intubation.

SPECIFIC SKILLS: THE CERVICAL SPINE

- You are now trained to evaluate a lateral cephalogram to determine whether the cervical spine is normal, or not. **If abnormal:**
  - You can now evaluate whether the dens of C2 is positioned under the basion, or whether it is displaced distal (re: basion) and may be subluxated (dislocated).
  - You can identify the Atlas-Dens Interval (ADI) and if it appears that the ADI is 3 mm or more, you know to measure it and refer the patient to a radiologist.
  - You can identify whether the odontoid process of C2 has intruded into the space of the foramen magnum, and know when to refer such a patient to a radiologist for definitive evaluation.
  - If you are ever unsure, just send an email to me.
WHAT I HOPE FOR YOU:
THE ADENOID MASS AND CRANIAL BASE ANGLE

In your future interactions with orthodontic referral sources, you should be able to view a lateral cephalometric radiograph on a mutual patient and:

Be able to tell which patients with a large adenoid pad should be recommended to have an additional lateral cephalometric radiograph taken (during a sustained phonation of “oo”) when a total adenoidectomy is recommended.

You should also be able to tell from that x-ray film whether a patient needs their adenoid pad to maintain velopharyngeal closure and would be better served to have a lateral (peritubal) adenoidectomy than a total adenoidectomy. You should know when to contact the ENT involved with such patients.

In observing a lateral cephalometric radiograph, and if you feel that there will be a deep pharynx if the adenoids are removed, you should be able to identify nasion, sella and basion and measure cranial base angle to determine whether the cranial base angle is obtuse.

MORE CLINICAL APPLICATIONS:
THE ADENOID MASS

You know how to follow the outline of the posterior pharyngeal wall up beyond the adenoid mass to predict what the pharynx will look like in the absence of the adenoid mass. You know when to recommend that an additional cephalometric radiograph is needed to be taken during a sustained phonation to fully evaluate the elevated velum and the negative impact on speech from a total adenoidectomy.

When a lateral cephalometric radiograph is taken during (the middle of) a sustained phonation of “oo”, “ah” or “ah”, you know how to evaluate the level of elevation of the velum and determine the “effective length” of the velum.

You will know what intraoral signs to look for that explain why a patient may have some variation in the adenoid mass, the cervical spine, or cranial base angle that may identify those patients as being “at risk” for developing persistent hypernasality if a total adenoidectomy is performed.

IMPLICATIONS AND CHALLENGES:
THE NEED FOR CLINICAL RESEARCH

Perhaps your interest will be tweaked enough from what you have learned to work with orthodontic referral sources who have taken lateral cephalometric radiographs on most or all patients of mutual interest to answer some currently unasked/unanswered questions:

Do OMDs represent an airway interference syndrome?

Are there morphological characteristics of patients with OMDs that are seen on lateral cephalometric radiographs? (Morphology is the science of the form and structure of organized beings)

Is there a higher incidence of cervical spine variations in patients with OMDs than in the general population?
CLINICAL RESEARCH QUESTIONS THAT CAN BE STUDIED WITH LATERAL CEPHS

● Do various types of OMDs show different cephalometric characteristics in growth and development?
● Do the cranial base angles of patients with OMDs differ from the general population?
● Do the faucial tonsils and adenoids of patients with OMDs exhibit a difference in growth cycles as compared with the general population? (lateral x-ray films will show this when taken over time)
● Do the vertical dimensions seen on lateral cephs differ in OMD patients from the general population (such as the growth of the ramus of the mandible)?

A (REPEAT) PERSONAL OFFER:

● If, in tracing or evaluating a lateral ceph, you see anything that you have a question about, feel free to email me a copy of the x-ray film and I will always be happy to provide my opinion.
● Or, if you need my help or advice with anything else that may crop up, please don't hesitate to contact me. I am happy to be of assistance.
● My email address (again) is oitsbob@sc.rr.com.

HYPERNASALITY OR HYPONASALITY?

● You should know how to teach a dentist or physician the difference between hypernasality and hyponasality.
● The patient says: “sing-song”, or “ding-dong, ting-a-ling”.
● If sounds are elongated, hypernasality is present.
● If sounds are shortened/truncated, hyponasality is present.
YOU KNOW YOU DRANK TOO MUCH
When you wake up beside Rach Jessica Parker
NORMAL FACIAL PROPORTIONS AND EYE SPACING:
CAN YOU DESCRIBE HER FEATURES?

ARE YOU FAMILIAR WITH THESE TERMS?

● MEDIAL CANTHUS – the end of the fissure at the medial corner of the eye.
● INTERCANTHAL WIDTH – the distance between the medial slits of the eye.
● MEDIAL LIMBUS – the medial rim of the iris of the eye.
● HYPERTELORISM – pathological spacing between the eyes (a feature of some craniofacial disorders [dysostoses]).
● ALAR BASE – the base of the nose.

REVIEW OF FACIAL ESTHETICS:
(THE FACE IS FIVE EYES WIDE)

Bell, Proffit and White, Surgical Correction of Dentofacial Deformities, 1980.
NORMAL FACIAL PROPORTIONS

THE VERTICAL DIMENSIONS OF THE FACE

- The midface accounts for about 40% of facial height in adults
- While the lower face accounts for approximately 60%.
- These figures are quite variable in children.

MEASURING FACIAL HEIGHT

- Midface height is measured by placing an index finger on the patient's nasal bridge (the upper limit of midface height) with the thumb positioned at the base of the nose.
- Next, the clinician keeps these dimensions constant and repositions the index finger at the base of the nose, with thumb now resting wherever it may touch on the chin.
- In the normal adult, the thumb fits into the soft tissue groove above the chin prominence, leaving approximately 20% of additional lower facial height uncovered.
- (NOTE: There is more variability among female adults than males in vertical facial proportions).
THE NASOLABIAL ANGLE

From Bell, Proffit and White, Surgical Correction of Dentofacial Deformities, 1980.

THE EXTERNAL NOSE

- The liminal valve (a.k.a. anterior nasal valve, or valve of Mink) parallels the outer contour of the nostril.

- From: Bateman and Mason, Applied Anatomy and Physiology of the Speech and Hearing Mechanism, 1884.

NORMAL FACIAL RELATIONSHIPS
THE LATERAL VIEW

From Bell, Proffit and White, Surgical Correction of Dentofacial Deformities, 1980.
HYPERTELORISM?

RESTING RELATIONSHIP OF UPPER INCISORS TO UPPER LIP
(MORE ON THIS LATER FROM THE CLASSIC RESEARCH STUDY OF VIG AND COHEN)

THE BUCCAL CORRIDOR
WIDE BUCCAL CORRIDOR
("BILLY" IN A CHANTIX CEASE-SMOKING AD, OR MICHAEL PHELPS)
WOULD AN ORTHODONTIST HAVE TEETH EXTRACTED TO TREAT THIS PATIENT?

“BALANCING” TONGUE AND CHEEK PRESSURES AGAINST THE POSTERIOR DENTITION
HOW IS A WIDE BUCCAL CORRIDOR EXPLAINED?

THE EYES

(I’m looking at you!!)
THE ORBITS
(AKIN TO SCOOPS OF ICE CREAM?)

- PROPTOSIS – (or exophthalmos): bulging eyes
- ENOPHTHALMOS – deep set eyes

EARS
(MOST EAR DEFORMITIES CAN BE TERMED A MICROTIA)

- PREAURICULAR TAG
- MICROTIA

INDIVIDUALS WITH DIFFERENT FACIAL WIDTHS CAN HAVE COMPATIBLE FACIAL FEATURES
THE LIPS

IS THIS AN “EVERTED” LOWER LIP

Do you see anything wrong here?
What would you look for next?

IS THIS A BIFID UVULA?
IS THIS RELATED TO THE LIP PITS?

What is this?
VAN DER WOUDE SYNDROME

- The most common syndromic form of oral clefting (besides cleft lip and/or cleft palate).
- Lip pits make it syndromic.
- The syndrome is occasionally associated with hypodontia.
- Van der Woude syndrome is considered to be autosomal dominant with variable expressivity and incomplete penetrance (NOTE: a single, abnormal gene on one of the first 22 non-sex chromosomes from either parent can cause an autosomal disorder).
- There are many gene mutations.

MOLDING EFFECT OF THE UPPER LIP ON THE DENTAL ARCH

LOGAN'S BOW
WHAT IS THIS?

POOR MUSCLE UNION ACROSS THE UPPER LIP IN A PATIENT WITH A REPAIRED BILATERAL CLEFT LIP

ABBE FLAP PROCEDURE
AFTER RELEASE OF LIPS

DIAGRAM OF ABBE FLAP SURGERY SEQUENCE

AN INTERESTING CASE

Unilateral mandibular deficiency (from trauma)
THE RIGHT SIDE OF THE BODY OF THE MANDIBLE IS HYPOPLASTIC

WHAT TO DO?

- Since the bones of the foot have a growth cycle similar to the mandible, we decided to amputate this patient’s little toe bone and use the joint as the angle of the mandible
- (an experimental operation!).

FINAL QUIZ FOR THIS SECTION:
WHAT IS GOING ON HERE?
PINNED APPLIANCE USED WITH SOME INFANTS FOR SEVERELY PROTRUDED PREMAXILLA AND BILATERAL CLEFT LIP AND PALATE
WHAT ABOUT LIP INCOMPETENCE?
BUT FIRST, HOW DO THE LIPS GROW?
INSIGHTS FROM THE CLASSIC STUDY OF GROWTH OF LIPS 
FROM THE RESEARCH OF VIG AND COHEN (AJO, 1979)

SUBJECT SELECTION IN THE VIG AND COHEN STUDY
For this study, serial radiographic records of untreated subjects obtained by Dr.
The positioning of the subject for radiography was carried out as follows: The p
The first fifty persons in Leighton's series, who had been followed up to the age
The term “lip incompetence” is a poor term to use with children who, normally, are expected not to have lip closure at rest until age 13. It is, however, an accepted and well-known term in dentistry and medicine.

For a patient with a forward rest posture of the tongue, lip (resistance) exercises can often obviate the need for specific work on repositioning the tongue. A patent nasal airway is necessary for success in therapy.
ORTHODONTIC RELAPSE RELATED TO THE LIPS

- lower lip to upper incisor relationship appears most important! (At rest, the lower lip should cover 2-3 mm of the upper incisors). (Vig and Cohen)
- increased muscle strength does not appear to be significant. (Barber and Bonus)
- If the lower lip covers 2-3 mm of upper incisors at rest (lip closure is not required), upper anterior teeth that have been orthodontically retracted will not relapse forward! (Mason)

FACTORS CONTRIBUTING TO ORTHODONTIC RELAPSE AND RECURRING TONGUE THRUST:

- poor resting relationship of lower lip to upper incisors
- incisors expanded forward during treatment
- intercanine width expanded during treatment
- late growth into open bite
- unresolved issues involving the airway
- abnormal rest posture of the tongue
- An abnormal, open freeway space

(Sources: Dr. Richard Riedel, U. of Washington Orthodontic Department studies; Dr. William Proffit; Dr. Robert Mason)

CAN LIPS BE STRENGTHENED?

BARBER AND BONUS STUDY (JADA, May, 1975)

Study of 41 pts with incisor protrusion and T-T swallow
Excised with lip button in labial vestibule
Lip scale measured tension in oz.
Followed 18 mo following Tx (3-6 mo Tx)
Findings:
After 18 mo, mean N. strength was 450% greater
Increased N. strength in lips does not produce an effect on dentition
INGERVALL AND ELIASSON (1982)
- EMG study showed that MFT can lengthen lips and reduce interlabial gap.
- Tooth position was not affected.
- Confirmed Barber and Bonus study.

THUER and INGERVALL (1986)
- Studied lip strength and resting lip pressures
- Lip pressures seem to adapt to facial morphology
- No correlation between lip strength and lip pressure.

ANOTHER STUDY – FROM JAPAN
- The research of Satomi (IJOM, 2001) revealed that while the button pull exercise increased lip power, the positive effects of lip seal or strength were not maintained over time.
- The author concludes that additional research is needed.

SUMMARY OF LIP STRENGTH STUDIES
- Lips can be strengthened by MFT.
- Lip exercises can achieve lip closure, or seal, in patients with flaccid lips.
- Lip exercises do not produce tooth position changes.
- So far, there is not good evidence that we can “grow” lips with MFT.
- Additional research is needed.
LIP EXERCISES

- They are a valuable tool in your therapy armamentarium.
- The exercises also encourage awareness of lip posture and provide self-monitoring of a closed lip rest position.

THE END
AIRWAY INTERFERENCES?
AN INTERDENTAL TONGUE POSTURE IS A CLUE

What is seen anteriorly may be linked to a posterior airway problem or a retained sucking pattern.

AIRWAY INTERFERENCE

- Patients with OMD’s would be expected to have a high prevalence of airway problems which may include enlarged tonsils and adenoids (with a long history of bouts of tonsillitis and adenitis), allergic rhinitis, septal deviations, enlarged nasal turbinates, and irregularity of the anterior nasal valve (the liminal valve).
- Lowest on this list of creating an airway interference is a deviated septum (Warren et al aerodynamic studies).
- It is tempting to attach the diagnostic label of mouth breathing when the patient has a lips-apart, mouth-open rest posture.
- Avoid this temptation!

“MOUTH BREATHING”

- “Mouth breathing” and a “lips-apart, mouth-open rest posture” are not necessarily synonymous.
- The term “mouth breathing” is a physiological term that should be verified by airway testing before the label is attached.
- Most “mouthbreathers” engage in some nasal breathing.
- Ideally, aerodynamic assessment should be accomplished; however this is not usually done and is not feasible in the typical clinical setting in MFT.
- An ENT or allergy workup is needed. (They do not usually test airflow – because they do not have the equipment).
A CASE IN POINT:
MOUTH BREATHING AND OTHER AIRWAY ISSUES IN
INDIVIDUALS WITH DOWN SYNDROME

A BRIEF DISCUSSION OF DOWN SYNDROME

Down Syndrome, or Trisomy 21, is a genetic craniofacial condition characterized by midfacial retrusion.
• Some characteristics of interest to OMTs include: generalized hypotonia, a short hard palate, a small oral cavity with a normal size tongue (a “relative” macroglossia), and a small, narrow nasal cavity and pharynx.
• Upper airway obstruction occurs in about 1/3.
• Maxillary retrusion indicates that the upper jaw is small, mostly in the horizontal plane. A small maxilla and hard palate contribute to a reduction of the area of the nasal cavity for establishing and maintaining a nasal pattern of breathing.

VARIOUS MEDICAL CONDITIONS THAT OCCUR FREQUENTLY WITH DOWN SYNDROME
THE NASOPHARYNX IN INDIVIDUALS WITH DOWN SYNDROME

- The nasopharynx is reduced in size due to the retruded palatal vault.
- The result is that the posterior wall of the pharynx is positioned closer to the tongue base.
- The consequence of this, of course, is that individuals with Down Syndrome may have difficulty breathing through the nose.

THE CRANIAL BASE ANGLE IN INDIVIDUALS WITH DOWN SYNDROME IS USUALLY ACUTE, AS WITH OTHER MIDFACIAL RETRUSION SYNDROMES.

(From Mason, Oral and Maxillofacial Surgery Clinics of North America, 3, August, 1991)

OMT TREATMENT CONSIDERATIONS

- In patients with Down Syndrome, the tongue rests forward to maintain the airway. As mentioned, this is a physiological need (obligatory mouthbreathing).
- With “good intentions”, some OMTs claim that they can reposition the tongue posteriorly and improve “muscle tone”. But since muscle tone is controlled by the cerebellum, and reduced muscle tone (hypotonicity) does not respond or improve with exercises, this claim is highly questionable.
- Also, the small pharynx, maxilla, and nasal cavity do not permit repositioning the tongue posteriorward, as some claim to do (without any documented evidence).
- Claiming that lip closure can be established in children with Down Syndrome is also questionable.
OMT TREATMENT OF CHILDREN WITH DOWN SYNDROME

- To determine a child with Down Syndrome’s ability to respond successfully from OMT, a minimum diagnostic assessment should include obtaining a lateral cephalometric x-ray film to evaluate the adequacy of the pharyngeal airway.
- An evaluation of a lateral ceph should include the cranial base angle, adequacy (and depth) of the pharyngeal airway, size of the adenoid mass, openness of the posterior choanae, and characteristics of the small, retruded maxilla.

TREATMENT RECOMMENDATIONS

Some teenagers and adult individuals with Down Syndrome may benefit from orofacial myofunctional therapy only if:

- A lateral cephalometric x-ray film of the head is obtained and evaluated with regard to the status of the characteristically small airway (with an acute cranial base angle).
- With continued facial and pharyngeal growth, some teenagers and adults with Down Syndrome may become acceptable candidates for therapy if their posterior airway is open and clear; that is, if obligatory mouthbreathing is no longer needed, but remains as a habit.
- It is unlikely that young children with Down Syndrome would have an open airway that would respond to lip closure exercises and reposturing of the tongue distally.
- Like any other orofacial myofunctional disorders, therapy will not be successful unless there is a clear airway as established by an ENT specialist or allergist.

AIRWAY INTERFERENCE
WHY MANY CHILDREN SNIFF
AERODYNAMIC ASSESSMENT INSTRUMENTATION
SOURCE: DONALD WARREN, DDS, PhD
DENTIST/PHYSIOLOGIST/SPEECH SCIENTIST

PRESSURE-FLOW PRINTOUT
(Riski and Mason)

INSIGHTS ABOUT BREATHING

1. Children have poor nasal hygiene. They need regular reminders to blow their noses (Mason).
2. The nasal breathing cycle for adults changes every 30-90 minutes; that is, there is always a more free-breathing nasal channel.
3. The cyclic change in free-breathing channel is not seen in children; both nasal chambers respond equally in normal circumstances.
A NASENDOSCOPE – A USEFUL CLINICAL TOOL

BENEFITS OF NASENDOSCOPY

With nasendoscopy, a clinician can view each nasal chamber, the posterior choanae, any tethering on the nasal surface of the velum, the relationship of the adenoid mass to the Eustachian tubes and the posterior choanae, the faucial tonsils, the pattern of velopharyngeal closure, and the dimensions of the posterior airway.

AIRWAY INTERFERENCES:
EVALUATING THE ANATOMY
(STUDIES BY WARREN AND ASSOCIATES)

- As a clinical perspective, it should be noted that evaluating the anatomy (as ENT’s do) does not adequately predict functions.
- Be wary of looking at the anatomy and presuming about the functions involved.
- This is especially true for the nasal septum, the faucial tonsils and the adenoids.
USEFUL CLINICAL GUIDELINE (REMINDER): CHECK THE POSTERIOR FAUCIAL PILLARS

HOW WOULD YOU DESCRIBE THESE TONSILS?

(ALMOST) “KISSING” TONSILS AND BIFID UVULA
THE FAUCIAL (OR PALATINE) TONSILS

- The external surface of the tonsils is covered by non-keratinized stratified squamous epithelium dipping into the tonsillar mass to form crypts. (Histologically, the faucial tonsils differ from the adenoids).
- By their location, the faucial tonsils act as a monitor for identifying and filtering allergens introduced into the oral cavity and body.
- The role of the tonsils in the development of the body's immunocompetent experience is still not fully understood.
- Physicians are now reluctant to remove tonsils and adenoids early in life, as was the norm at age 5 when I was a child.

SWOLLEN FAUCIAL TONSILS:
A CONSEQUENCE OF OROPHARYNGEAL OBSTRUCTION

- Obstruction can be related to many things – infection, allergies, cold viruses, or bacteria.
- Streptococcal bacteria is a common finding where tonsils are enlarged, and toxins produced by a particular strain, Group A beta-Hemolytic Streptococcus (GABHS), can potentially lead to damage of the heart or kidneys.
SOME MEDICAL INDICATIONS FOR TONSILLECTOMY

- Recurrent tonsillitis
- Respiratory tract obstruction
- Severe sleep apnea

NOTE: It is NEVER appropriate for an OMT (or an orthodontist) to recommend surgical removal of tonsils due to the perceived diagnosis of ‘mouthbreathing’.

CLINICAL APPLICATIONS

- Blood loss and even death can follow from tonsillectomy and adenoidectomy. Postoperative undetected bleeding is the primary cause.
- Tonsils should be recommended for removal for medical reasons, not for growth and development factors.
- It is not appropriate for an OMT to recommend any surgery! (including a lingual frenum release)

HOW DO TONSILS AND ADENOIDS GROW?

FIRST, SOME BACKGROUND:

(IMPORTANT PERSPECTIVES WORTH REMEMBERING)

Scammon’s (classic) growth curves (1930) show the development of major tissues organs of the body. Most muscles and bones follow the general body type curve.

Next, let’s add the growth cycle for tonsils and adenoids (Source: Handelman, Pruzansky and Mason, 1967), as well as growth of the maxilla, mandible and tongue. (Growth of maxilla from growth data of Woodside (1970), and mandible and tongue growth are extrapolated from data by: Brodie [1962, 1961, 1962], Bjork [1963] and Woodside [1970]).
THE ADENOIDS (NASOPHARYNGEAL TONSILS)

● The external surface of the adenoid mass is covered by respiratory epithelium; pseudo-stratified ciliated columnar epithelium with goblet cells.
● May be replaced in part or in the main by stratified squamous epithelium over time.
● Has a folded or corrugated surface simulating crypts.
● The adenoid mass is an important contact area for velopharyngeal closure.

From: HANDelman, PRUZANSKY AND MASON, 1967
(OOPS! “SPARSE” IS MISS-SPelled)

ADENOID GROWTH AND INVOLUTION

● The adenoids can be large as early as age 3, and normally will remain large until atrophy (involution) begins around age 12, (with a normal range of +/- 3 years) for the inception of the involution process.
● The faucial tonsils usually follow a similar growth and involution process and timing; however, one should not presume about adenoid size by evaluating the faucial tonsils.

(Handelman, Pruzansky and Mason, 1967)
ADENOID INVOLUTION BEGINNING AT @ AGE 9 YEARS

(From R. Ricketts)

NORMAL VELOPHARYNGEAL CLOSURE AGAINST THE ADENOID PAD
The velum is contacting the lower, concave portion of the adenoid mass

Velopharyngeal closure against the adenoid pad at contact #1 presents the greatest risk of developing hypernasality following adenoid removal or involution.
(from Mason and Warren, JSHD, 1980 – article provided)
“TOUCH” CLOSURE (R)
a risk in maintaining velopharyngeal closure with
involution of the adenoids

SHORT QUIZ:
WHAT WOULD YOU PREDICT ABOUT SPEECH
(NASAL VOICE QUALITY) FOLLOWING A
TOTAL ADENOIDECTION IN THE NEXT
PATIENT?

REST
SUSTAINED PHONATION

Denasal speech due to excessive adenoid tissue ~
soft palate at rest (clear) and during elevation (stippled)
(From Subtelny and Koepp-Baker, 1956)

INDICATIONS FOR ADENOIDECTION

- Recurrent nasal discharge
- Repeated bouts of otitis media
- Upper respiratory tract obstruction
- Conductive hearing loss
- Severe sleep apnea
SURGICAL REMOVAL OF ADENOIDS

- Surgical removal of adenoids can result in persistent hypernasality in individuals with submucous cleft palate, bifid uvula, tethering of the soft palate, repaired cleft palate, short velum, or a neuromotor deficit involving the velum.
- For such patients where there is a medical need for adenoidectomy, such as from tissue encroachment over the Eustachian tubes, a lateral (peritubal) adenoidectomy can be accomplished (now a nasendoscopically-aided surgery is being done by many ENT’s).

PERSISTENT HYPERNASALITY FOLLOWING ADENOIDECTOMY: TREATMENT OPTIONS

- The two primary treatment modalities: surgery or prosthetics.
- Surgery is preferred because it is permanent, while prosthetic appliances need to be taken in and out, cleaned, and depend upon a healthy dentition to keep the appliance in place.
- Surgery options: pharyngeal flap or sphincter pharyngoplasty.
- Prosthetic options: under-and up appliance or palatal lift.
- Speech therapy is not an option for most velopharyngeal gaps. The velum cannot be lengthened through speech therapy exercises (for example, “blowing” exercises accomplish nothing).

HOW TO DETERMINE WHETHER THERAPY WILL RESOLVE HYPERNASALITY

- If after 3 months following an adenoidectomy the patient continues to be severely hypernasal,
- Instruct the patient to count 1-20 regularly, then have them recount 1-20 while over-exaggerating mouth movements.
- If hypernasality is significantly reduced during exaggerated counting, the patient is a candidate for trial speech therapy to remedy the hypernasality.
- If the hypernasality does not significantly decrease with exaggerated productions while counting, then your therapy will not be successful.
- The patient should be referred to a surgeon or prostodontist.
WHY IS OVEREXAGGERATED COUNTING A USEFUL ASSESSMENT OF WHETHER THERAPY WILL BE EFFECTIVE, OR NOT?
The oral ring of muscles has a direct and reciprocal relationship with the pharyngeal ring of muscles via the buccinator and superior constrictor that join at the pterygomandibular raphe.

WHAT ARE THE TREATMENT OPTIONS WHEN SPEECH THERAPY WILL NOT BE SUCCESSFUL?

- A pharyngoplastic surgery:
  - Superiorly-based pharyngeal flap.
  - Sphincter pharyngoplasty.
- Prosthetic management:
  - Under and up prosthesis
  - Palatal lift prosthesis.

LATERAL VIEW OF A SUPERIORLY-BASED PHARYNGEAL FLAP
SPHINCTER PHARYNGOPLASTY
(MOBILIZING THE PALATOPHARYNGEUS MUSCLES)

THE RESULT:
THE PALATOPHARYNGEUS MUSCLES WRAP AROUND THE WALLS OF THE PHARYNX AND OVERLAP AT THE MIDLINE OF THE POSTERIOR PHARYNGEAL WALL TO NARROW THE VP PORT

“UNDER AND UP” PROSTHESIS
PALATAL LIFT APPLIANCE

PALATAL LIFT APPLIANCE IN PLACE
(THE LENGTH AND VERTICAL DIMENSIONS OF THE APPLIANCE ARE ADJUSTED ACCORDING TO NASENDOSCOPIC OBSERVATIONS)

CASE REPORT
A FAILED PROCEDURE FOR SNORING/SLEEP APNEA:
U.P.P.P. OPERATION

Uvulopalatopharyngoplasty procedure
Involves amputating the uvula and part of the posterior soft palate, making a “McDonald’s arch” out of the posterior palate
Used for treatment of snoring and some obstructive sleep apnea problems

CASE REPORT OF U.P.P.P.

The complication of tissue scarring and nasopharyngeal stenosis following UPPP with tonsillectomy and adenoidectomy, in a 17 year old female with life-long breathing problems, requiring a team approach involving a plastic surgeon, speech-language pathologist, and prosthodontist.

CASE REPORT:
PATIENT WITH SEVERE STENOSIS OF THE VELOPHARYNGEAL AREA

Appearance of stenotic region prior to our management.
NASENDOSCOPIC VIEW OF CONSTRICTED PHARYNX

APPLIANCE FOR CONSTRICTED AIRWAY

COMBINATION PALATAL LIFT AND VELOPHARYNGEAL PORT EXPANDER FOR CONSTRICTED PHARYNX
VELUM AND PHARYNX AFTER SURGERY AND PROSTHETIC STABILIZATION

NASENDOSCOPIC VIEW OF PHARYNX FOLLOWING SURGICAL REVISION AND PROSTHETIC STABILIZATION

ADDITIONAL CLINICAL APPLICATIONS: AIRWAY ISSUES AND THE OROFACIAL MYOLOGIST
BREATHING EXERCISES FOR AIRWAY INTERFERENCES?

- There is a difference between habituating a nasal pattern of breathing and engaging a patient in breathing exercises.
- There is no good evidence that individuals with OMDs have any whole-body breathing problems that would require treatment; that is, breathing problems have not been shown to be a characteristic of individuals with OMDs.

SLEEP APNEA AND THE OFM

The muscular phenomena, actions, and interactions involved in sleep apnea are complex. Those with credentials in this area involve professionals such as dentists, speech-language pathologists, and respiratory therapists.

Answers will likely be revealed through research studies in this area.

WHAT ABOUT PALATAL/PHARYNGEAL MUSCLE EXERCISE FOR SLEEP APNEA (OSAS)?

Is there a role for the OFM?

ASHA says “NO” to its OFM members:

Document: Orofacial Myofunctional Disorders: Knowledge and Practice

Members of committee: for ASHA - Robert Mason (chair),
TASK 9.0 Demonstrate Professional Conduct Within the Scope of Practice for Speech-Language Pathology

9.b.....the practice of orofacial myology does not include:
1) Treatment of parafunctional problems related to temporomandibular joint disorders and myofascial pain dysfunction,
2) Nutritional counseling or management,
3) Craniosacral manipulation or practices within the scope of physical therapy, or,
4) Practices related to the reduction of medical conditions,

SLEEP APNEA: WHY ASHA MEMBERS ARE MANDATED NOT TO PROVIDE SERVICES FOR PATIENTS WITH SLEEP APNEA AND TMJ CONDITIONS

- SLEEP APNEA IS A MEDICAL PROBLEM, not a dental or OFM problem.
- Any participation in the experimental treatment of sleep disordered patients (OSAS) through exercise or any other means (counseling regarding sleep positions, type of pillow, etc.) should be done only after referral from a medical sleep lab.
- Currently, there are no verified evaluation and treatment protocols for sleep apnea developed by OMTs.
- Accordingly, OFM's have no credentials or expertise to participate in the evaluation or treatment of OSAS or any sleep disorder.
- Perhaps there will be an appropriate role for the OFM in the future? But not yet!

JUST A FEW OF MANY UNRESOLVED QUESTIONS THAT NEED TO BE ANSWERED REGARDING THE OBSTRUCTIVE SLEEP APNEA SYNDROME (OSAS) AND ASSOCIATED MUSCLE FUNCTIONS:

- What would be accomplished by exercising the muscles of the velum? (muscle "strengthening" exercises tend to shorten and fatten muscles – but no effect has been shown with velar muscles).
- What is the evidence that muscle exercises involving resting tongue position carry over to sleep cycles?
- What would be accomplished by exercising the pharyngeal constrictor muscles? Would their attachments permit change from exercise other than to further constrict the airway?
A FEW APPROPRIATE TOOLS OF INVESTIGATION FOR SLEEP DISORDERS

Needle electromyography – (has already been done in the palate and some areas of the pharynx).
Dynamic MRI – now in use experimentally in several centers, including the University of Illinois, Champaign-Urbana, and Eastern Carolina University, Greenville.
Aerodynamic airway testing.
Electromagnetic midsagittal articulography (EMMA).
Drug regimes – studies underway in several university medical centers.
Dental appliances – forward positioning of the mandible (diagnostic appliances and palliative measures only).

DENTAL APPLIANCES FOR SLEEP APNEA

- Following evaluation at a medical sleep lab, many dentists will construct a dental appliance to alleviate sleep apnea during nighttime sleeping.
- There are a variety of appliances that are being used.
- Most are mandibular advancement devices (MAD).
- In some patients, surgery may be the procedure of choice.
- There is no clear role established for orofacial myologists with sleep-related breathing problems, including snoring, for patients wearing appliances.
- Nonetheless, some OMTs are involved with sleep apnea patients, without having established any verified evaluation and treatment protocols. I recommend against this.
- ASHA mandates that its members refrain from providing therapy for not only sleep apnea, but also craniosacral manipulations, and TMJ disorders. (It is recommended that dental hygienists accept and follow the same recommendations mandated for colleagues in speech pathology)
- A copy of the ASHA “Knowledge and Skills” document is provided

MANDIBULAR ADVANCEMENT DEVICE (MAD) FOR SLEEP APNEA AND SNORING
MANDIBULAR ADVANCEMENT APPLIANCE FOR SLEEP APNEA WITH A HERBST PISTON

MANDIBULAR ADVANCEMENT SPLINT FOR TMJ AND SLEEP APNEA PROBLEMS

MANDIBULAR ADVANCEMENT DEVICE FOR SLEEP APNEA
WHEW! THIS TIRES ME OUT!
You will impress your referral sources when you correctly use dental terminology.

Although you will not be making dental diagnoses, you can make observations and then ask that they be verified or clarified by the dentist or orthodontist involved.

Don't hesitate to use dental terminology with dentists.

Dentists will respect you when you understand what they may say using their own terminology.

PRIMARY AND ADULT DENTITIONS:
THE MAXILLARY ARCH
PRIMARY AND ADULT DENTITIONS:  
THE MANDIBULAR ARCH

SOME DENTAL TERMINOLOGY TO DESCRIBE AN AREA

TERMS TO EXPRESS VERTICAL RELATIONSHIPS
SURFACES OF TEETH

DIASTEMA
(THIS ONE A MIDLINE MAXILLARY DIASTEMA)

NORMAL OVERBITE AND OVERJET
(ALSO CALLED NORMAL VERTICAL OVERLAP AND HORIZONTAL OVERLAP)
ANTERIOR OPEN BITE AND POSTERIOR CROSSBITES

CROSSBITE CONSIDERATIONS:
VARIOUS TYPES OF EXPANSION INVOLVED

EXPANSION TO CORRECT
A POSTERIOR CROSSBITE

THE ANGLE CLASSIFICATION OF OCCLUSION:
BASED UPON BITING RELATIONSHIPS AT THE FIRST
MOLAR TEETH

CLASS I OCCLUSION
NOTE REGARDING TERMINOLOGY

- Note: The term craniofacial development is seen on some OMT websites, and apparently is being taught as an appropriate designation to use in some courses on OMDs.
- For most individuals receiving OMT, the cranial sutures have been closed for many years.
- There is no evidence that therapy for OMDs has any influence or impact on the cranial sutures.
- The term craniofacial development is best avoided in website claims and in other discourses about patients with OMDs.
- As a craniofacial orthodontist, this designation denotes my specialized training and experience with patients possessing a variety of craniofacial syndromes and dysostoses (defective ossification of bones).
CLASS II MALOCCLUSION
(SOURCE: MASON, OROFACIAL PHYSIOLOGY: BEYOND TONGUE THRUST, ASHA TELECONFERENCE, 1996)

CLASS II MALOCCLUSION

CLASS II DENTAL MALOCCLUSION
NOTE ON ORTHODONTIC TERMINOLOGY

Most orthodontists throughout the world will express observations about rotational growth changes in the jaws as if the patient is being viewed from the right, lateral dimension. Examples will follow.

CLASS II SKELETAL MALOCCLUSION
(WHY IS THIS A SKELETAL PATTERN?)

CLASS III MALOCCLUSION
CLASS III SKELETAL MALOCCLUSION

SEVERE CLASS III SKELETAL MALOCCLUSION WITH A COUNTER-CLOCKWISE ROTATION OF THE MAXILLA RESULTING IN POSTERIOR MAXILLARY VERTICAL EXCESS. A SEVERE MANDIBULAR PROGNATHISM IS SEEN. BOTH DENTAL ARCHES SHOW DENTAL COMPENSATIONS

SUMMARY: DENTAL AND SKELETAL MALOCCLUSIONS
(Source: Bell, Proffit & White, Surgical correction of dentofacial deformities, V 1, 1980)
QUIZ: DOES THIS WOMAN HAVE A DENTAL OR SKELETAL MALOCCLUSION?

QUIZ: SKELETAL OR DENTAL? WHAT TIPPED YOU OFF?

DID YOU NOTICE THESE FACTORS?

- The severe Class III relationship at the molars.
- The anterior dental compensations to the malocclusion.
- The large anterior open bite.

IMPORTANT POINT TO REMEMBER:
- Orthodontics is an 8 mm specialty.
The curve of Spee describes a natural curve in the dental arch, sloping slightly downward from the molars and then back up at the incisors.

- Fixed full orthodontic treatment routinely eliminates the curve of Spee as the dental arches are leveled during treatment.
- However, there are curved archwires available that maintain the curve of Spee. These archwires are often used where there is an anterior openbite.
THE RICKETTS “ESTHETIC LINE”

The “E” line is an imaginary line extended from tip of nose to chin.
- For a normal profile, the upper lip should be just behind the line.
- The lower lip should be near or at the line.
- When the lips rest ahead of the “E” line, extraction of teeth is sometimes needed to produce a pleasing smile.

THE RICKETTS “E” LINE
QUIZ: IS THIS A NON-EXTRACTION ORTHODONTIC CASE?

THE WIDE RANGE OF NORMAL
SHORT QUIZZES

Check out the following photos
to see if you are “getting it” so far!

COULD OROFACIAL MYOFUNCTIONAL THERAPY ELIMINATE THIS 21 y/o WOMAN’S THUMB SUCKING HABIT, TONGUE THRUSTING AND ANTERIOR REST POSTURE OF THE TONGUE?

1st OF 4 PHOTOS OF PATIENT.
WHAT DO YOU SEE?
SKELETAL OR DENTAL?

THIS CONDITION IS CALLED VERTICAL MAXILLARY EXCESS. WILL SHE NEED SURGERY, OR WILL LIP EXERCISES SUFFICE?

THE EXTENT OF THE DOWNWARD GROWTH OF THE MAXILLA (OR, ANTERIOR AND POSTERIOR VERTICAL MAXILLARY EXCESS)
CLINICAL PERSPECTIVES ABOUT CROSS BITES AND PALATAL EXPANSION

● A dental maxillary posterior bilateral cross bite is a red flag signaling a possible airway problem.
● The house that the tongue lives in should be structurally normal, if possible, before myofunctional therapy is initiated.
● In most instances, hard palate expansion should be completed prior to myofunctional therapy, especially if a rapid palatal expansion appliance is used.

AN “RPE” IN PLACE
NOTE THE “JACKSCREW” IMBEDDED IN THE APPLIANCE
PERSONAL OBSERVATIONS REGARDING “RPEs”

I do not like them!

Seldom is equal expansion needed from canine to molars. Thus, I always use the Porter (W) appliance to accomplish “differential” expansion.

As an SLP, I think that RPE’s are bulky, can interfere with speech, and I dislike them from a speech standpoint.

An RPE should NEVER be used with a cleft palate patient. There is no midpalatal suture to begin with. (Rapid expansion can create an oronasal fistula in a patient with a repaired cleft palate).

PORTER OR “W” PALATAL EXPANSION APPLIANCE

THE “W” ARCH AND QUAD HELIX EXPANDERS
A LINGUAL SHIELD FOR A LATERAL OPEN BITE

PALATAL VIEW OF RPE AND BILATERAL LINGUAL SHIELDS

A TONGUE THRUSTER WITH A FORWARD TONGUE REST POSTURE AT AGE 8. WILL THIS CHILD NEED A HABIT APPLIANCE OR THERAPY? WHAT IF NOTHING IS DONE?
LATERAL VIEW SHOWING INCISOR PROTRUSION

AGE 12 – NO ORTHODONTIC OR OTHER TREATMENT. HOW IS THIS EXPLAINED?

SOME ORTHODONTIC PERSPECTIVES

DISCLAIMER:
I WILL EXPRESS AND IDENTIFY MY PERSONAL OPINIONS HERE
BOTTLE FEEDING AND TONGUE THRUST

HANSON AND COHEN STUDY

- A study by Hanson and Cohen (1973) dispelled the early claim by Straub (1960) that bottle feeding causes tongue thrusting.

HARD PALATE/MAXILLARY ARCH-SHAPING PACIFIER CLAIMS
The consensus in orthodontics is that pacifiers, including the Nuk Sauger, have no effect on shaping the vault of the palate or influencing the width of the maxillary dental arch.

Pacifier users have significantly greater overjet, posterior cross bites, anterior open bites, and a higher prevalence of Class II malocclusions. (Nowak and Warren, Pediatric Clinics of North America, 47: 1043-1065, 2000).

These are correlations only and do not prove cause and effects. Nonetheless, palate-shaping pacifiers do not do what they claim.

For a patient with tongue thrust and a thumb sucking habit:

as long as there is a sucking habit, the tongue thrust will remain.

(Illustration: W. Proffit, in Enlow and Hans, 1996)
THE DENTITION AFTER A THUMB SUCKING HABIT HAS BEEN ELIMINATED BY OROFACIAL MYOFUNCTIONAL THERAPY
(SOURCE: BATeman AND Mason Text, 1984)

THE LINGUAL FRENUM

A SHORT LINGUAL FRENUM
CLINICAL PERSPECTIVE:

- When surgery for a restricted frenum is performed by a plastic or oral/maxillofacial surgeon, a lengthening procedure is used; however, many dentists also provide this service.
- The lazer, used by many dentists and dental specialists, achieves a successful result in most patients.
- However, not all lasers or practitioners are alike, and this accounts for post-op problems that may occur.
- Except in newborns, release of a short, restricted frenum by a “clipping” procedure, is seldom indicated.

A SHORT, TETHERED LABIAL FRENUM

SOME BRIEF TMJ/TMD PERSPECTIVES
WHAT IF?
WOULD YOU TRY TO CORRECT AN ASYMMETRICAL MOVEMENT OF THE MANDIBLE?
(NOTE: A TUMOR HAS DEVELOPED IN PATIENT ON RIGHT)

PATIENT WITH LOSS OF VERTICAL DIMENSION.
WOULD YOU ACCEPT THIS PATIENT FOR THERAPY?
(NOTE THE OVERCLOSED POSITION OF THE MANDIBULAR CONDYLE)

DO YOU FEEL QUALIFIED TO TREAT THIS PATIENT WITH
TMJ PAIN AND AN “OVERCLOSED” BITE SITUATION?
(A POSTERIOR COVERAGE NITEGUARD APPLIANCE WOULD OPEN THE BITE SLIGHTLY AND
RELIEVE THE OVERCLOSED POSITION OF THE MANDIBULAR CONDYLE)
(SHORT-TERM APPLIANCE TREATMENT IS NOT AN ACCEPTABLE LONG-TERM SUBSTITUTE
FOR DENTAL IMPLANTS AND BRIDGES).
Many dentists and orthodontists will treat TMJ pain disorders with removable appliances. I have made a soft niteguard for some patients as a “diagnostic appliance”. If the pain ceases, great, but if pain continues, I refer them on to an oral surgeon who has the radiographic equipment available in hospital settings to definitively assess the joint apparatus. This most often involves injecting dye into the joint as part of a radiation study (an arthrogram).

ASHA MANDATE FOR SPEECH-LANGUAGE PATHOLOGISTS

- ASHA mandates that members should not provide treatment for patients with TMJ/TMD. (The ASHA document is provided).
- I recommend that all IAOM members refrain from treating the noxious habits associated with TMD’s such as clenching and grinding. Why?
- There is a great risk that the TMJ disc (meniscus) may perforate, or that pain in the TMJ area, or elsewhere, may increase for some unexpected reason during your therapy.
- If this happens, what legal defense would you have?
- What expertise with TMJ disorders pain management could you claim and defend in court? (How about none?)

MY RECOMMENDATION:

IF YOU AGREE TO BECOME A PART OF A TMD TEAM, YOU SHOULD REQUEST HAVING PATIENTS PROVIDED WITH A (SOFT OR HARD) BITE-OPENING APPLIANCE THAT RE-ESTABLISHES A NORMAL FREEWAY (VERTICAL) DIMENSION.

YOUR GOAL THEN IS TO TEACH THE PATIENT TO HABITUATE THIS NORMAL VERTICAL REST POSITION.
TWO EMG STUDIES OF TONGUE POSITION USING NORMAL PAIN-FREE ADULT SUBJECTS. BOTH STUDIES RECOMMEND A TONGUE DOWN BEST POSITION FOR PATIENTS WITH OROFACIAL/TMJ PAIN

EFFECTS OF TONGUE POSITION ON MANDIBULAR MUSCLE ACTIVITY AND HEART RATE FUNCTION
Authors: Schmidt, Carlson, Usery, & Quevedo.
Conclusions: If an individual presents with pain or discomfort in the muscles of the face and/or the
The present study provides evidence that tongue position influences both motor and cardiac vagal activity.

MODULATION OF MASTICATORY MUSCLE ACTIVITY BY TONGUE POSITION
Authors: Takahashi, Kuribayashi, Ono, Ishikawa, & Kuroda.
Conclusions: We concluded that masticatory muscle activity is affected by tongue position.

THE END
ORTHODONTICS

● "ORTHODONTICS" is the preferred term for this specialty area of dentistry. Many in the public say "ORTHODONTIA". (Please don't say orthodontia to an orthodontist or use the term in your reports)
● Orthodontic training involves three additional year after the completion of four years of dental school
● Few spots are available in orthodontic residency programs. This is because dental schools graduate around 100 students per year - but each graduate program in orthodontics can only accept from 4 to 6 students per year; hence, competition for spots in orthodontic programs is very competitive, and limited.

WHAT ABOUT EARLY ORTHODONTIC TREATMENT?
PERSONAL VIEWS:

● Early treatment, or Phase 1 treatment, remains controversial.
● In some instances, early treatment may be needed, but I am not a fan of two phases of orthodontic treatment.
● I do not want parents to pay for their child's orthodontic treatment more than one time.
● I also want to keep a child's cooperation "in the bank" for as long as possible, for later use; hence, I have avoided early treatment, with some exceptions, of course.
IS EARLY TREATMENT OF CROSS BITES NEEDED?

- Cross bites in children usually represent a condition rather than a disease.
- Usually, a cross bite can be corrected in a child by slightly grinding the teeth.
- If there is no functional problem, no treatment is indicated.
- I have avoided correcting anterior and posterior cross bites until functional problems arise.

PHASE 1 TREATMENT (CONTINUED)

- I have fit a child with a space maintainer when I thought that space in the dental arch may be lost after a primary tooth exfoliates and the adult tooth replacing it is not expected to erupt soon after.
- Some children with excessive protrusion of upper anterior teeth face the risk of losing teeth due to trauma. These children should receive limited treatment to retract the upper anterior teeth.
- Where a child’s maxillary protrusion becomes a serious psychological problem, limited treatment to retract the anterior teeth is also indicated.
- Spacing of teeth in the anterior dental segments of the primary dentition is a good sign since the adult anterior teeth that replace the primary incisors are much wider than their primary counterparts. No early treatment for spacing is indicated.
- Some children with repaired cleft and palate conditions will require early orthodontic treatment as part of their overall cleft palate team plan.

DO ALL DENTAL “CONDITIONS” REQUIRE TREATMENT?

- One thing I have learned early on in my orthodontic career:
  - Mother Nature is much smarter than I am!
- If there is ever any question about whether to treat or wait for the adult teeth to erupt (except for the second and third adult molars), treatment can always be successful if I wait,
  - so that is what I have done – with no regrets, over 30 years!
- I have monitored the potential problems in children shown in the previous slide rather than treating the various conditions “just because they are there”.
WHAT IS MIXED DENTITION?

- “Mixed dentition” describes the dental stage in which some primary teeth and some adult teeth occur together.
- Mixed dentition begins with the eruption of the first adult tooth – usually a first adult molar or a lower incisor.
- Mixed dentition continues until all primary teeth have exfoliated.

ORTHODONTIC TREATMENT OF ADOLESCENTS AND ADULTS

- Q: When is the best time to initiate full orthodontic treatment?
- A: When all adult teeth have erupted (except for 2nd or 3rd molars).
- The usual time is between 12 and 13 years of age.

WHAT TERMINOLOGY SHOULD OROFACIAL MYOLOGISTS KNOW ABOUT ORTHODONTIC TREATMENT MECHANICS?
CLOSE-UP OF “BRACES” (FIXED APPLIANCES)

TYPES OF “BRACES”

“CLEAR” FIXED BRACES
COATED ARCHWIRES (NOT SHOWN) APPEAR CLEAR BUT
STAIN EASILY
“INVISALIGN” APPLIANCE

INVISALIGN IN PLACE

LINGUAL BRACES (OUCH!)
THIS PERSON WOULD BENEFIT FROM BRACES AND CLASS II ELASTICS

A “TAD” (TEMPORARY [BONE-SUPPORTED] ANCHORAGE DEVICE) THAT PROVIDES SKELETAL ANCHORAGE TO (IN THIS CASE) RETRACT THE ANTERIOR TEETH WITH CLASS II ELASTICS

A “TAD” IMBEDDED IN THE HARD PALATE TO MOVE A BUCCALY-POSITIONED BICUSPID AND MOLAR INTO THE DENTAL ARCH
ELASTIC USED TO PULL A PALATALLY DISPLACED (OR ECTOPIC) CANINE INTO THE DENTAL ARCH

LIP BUMPER WITH BRACES

APPLIANCES THAT EXPAND THE HARD PALATE
THE “RPE” (RAPID PALATAL EXPANDER)

EXPANSION TO CORRECT A POSTERIOR CROSSBITE – AN ILLUSTRATION OF THE SITUATION

THE QUAD-HELIX HARD PALATE EXPANDER
PORTER OR “W” PALATAL EXPANSION APPLIANCE

A SPACE MAINTAINER
(TO MAINTAIN SPACE IN THE ARCH AS THE PRIMARY TEETH EXFOLIATE)

“W” APPLIANCE WITH SPRINGS ADDED TO EXPAND THE CANINES
SPRING IMBEDDED IN A REMOVABLE APPLIANCE TO MOVE AN INCISOR INTO THE DENTAL ARCH

HEADGEAR TO RETRACT MAXILLARY TEETH
THE OUTER BOW IS ATTACHED POSTERIORLY TO EITHER A NECK STRAP OR HEAD STRAP.
INTRAORALLY, THE INNER BOW FITS INTO TUBES ATTACHED TO MOLAR BANDS.

HIGH-PULL HEADGEAR STRAP
"REVERSE" HEADGEAR TO ADVANCE THE MAXILLA (EFFECTIVE UP TO AGE 11). THIS HEADGEAR IS NOT WORN AT SCHOOL.

THE LATEST – NO MORE FACE MASKS

“FUNCTIONAL” APPLIANCES

THESE APPLIANCES ARE DESIGNED TO INFLUENCE AND MODIFY THE HORIZONTAL AND/OR VERTICAL POSITION OF ONE OR BOTH JAWS.
A BIONATOR FUNCTIONAL APPLIANCE (TO INFLUENCE TEETH AND JAWS IN THE VERTICAL DIMENSION)

TOP VIEW OF A BIONATOR

THE FRANKEL APPLIANCE: INVENTED BY EAST GERMAN ORTHODONTIST ROLF FRANKEL DURING THE TIME OF THE BERLIN WALL. METAL WAS SCARCE AND DR. FRANKEL WAS UNABLE TO BUY OR MAKE ORTHODONTIC BRACKETS.

THE FRANKEL APPLIANCES, MADE FROM WIRES AND ACRYLIC, USE THE UPPER AND LOWER LIMITS OF THE BUCCAL VESTIBULE FOR ANCHORAGE TO CHANGE JAW POSITIONS.
A FRANKEL TO ENCOURAGE LOWER JAW “GROWTH”

A TWIN BLOCK FUNCTIONAL APPLIANCE DESIGNED TO CREATE A FORWARD POSTURE OF THE MANDIBLE

“PUNITIVE” HABIT APPLIANCES
(I DO NOT USE THEM)

NOTE: DR. HONOR FRANKLIN AND I AUTHORED THE POSITION PAPER AGAINST THE USE OF HABIT APPLIANCES THAT IS NOW I.A.O.M. POLICY

YOU CAN FIND AND COPY THE DOCUMENT FROM THE WEBSITE LINK SHOWN ON A HANDOUT PAGE
“HAYRAKE” HABIT APPLIANCE (WITH PUNITIVE PRONGS)

ANOTHER PUNITIVE APPLIANCE WITH PRONGS TO ELIMINATE THUMB AND FINGER HABITS

OH MY? IT MAKES ME SICK JUST LOOKING AT THIS APPLIANCE INTENDED TO STOP THRUSTING
APPLIANCE FOR THUMB SUCKING AND TONGUE THRUSTING

“BLUEGRASS” APPLIANCE WITH ROTATING SLEEVE OVER A WIRE, DEVELOPED AT THE UNIVERSITY OF KENTUCKY DENTAL SCHOOL BY SOME OF MY PREVIOUS PROFESSORS. (KENTUCKY IS KNOWN AS THE “BLUEGRASS” STATE)

EXPANSION APPLIANCE WITH INTRUSIVE WIRES TO DISCOURAGE TONGUE THRUSTING
"MYOFUNCTIONAL" APPLIANCES

NOTICE THE TONGUE GUARD ON THIS "MYOFUNCTIONAL" APPLIANCE

HAWLEY RETAINER TYPES
HAWEY RETAINER WITH ANTERIOR BITEPLATE
(GOOD RETENTION FOR PREVIOUS DEEP ANTERIOR OVERBITE)

THE TYPE OF HAWLEY I HAVE USED

REMINDER GROOVE ADDED TO RETAINER
INVISALIGN RETAINER

VARIOUS FIXED-WIRE RETAINERS

SIMPLE ACRYLIC SPLINT USED FOR CLENCHING, GRINDING, AND SOME TMJ SYMPTOMS
TO EXTRACT TEETH OR NOT

- There is a continuing criticism, perpetrated largely by general dentists who compete for orthodontic patients with orthodontists, that extraction of teeth in orthodontics is never indicated.

- This claim not only has no merit, it is naive and patently ridiculous!

- Treating protrusive teeth by retracting and expanding the entire dentition does not always result in a pleasant profile.

- If anterior teeth at rest are positioned well ahead of the esthetic (E) line, and lip competence is not possible, consideration should be given to extracting selected teeth (usually the first bicuspids) to make room for anterior teeth be retracted into.

CLAIMS MADE ON THE WEBSITE OF THE INTERNATIONAL CENTER FOR NUTRITIONAL RESEARCH

Claim: “Balancing the skull bones helps insure a more normal neurologic and spinal function throughout the patient’s life”.

ALF Orthopedic Expansion – Non-Extraction 2.3 Years Treatment

“Conventional orthodontic treatment recommended extraction of four healthy bicuspids teeth for a 12-year-old, Melissa T. to make room for the crowded remaining teeth. The crowding was created by under development of the patient’s dental arches. By removing teeth the genetic potential for growth of the patient’s jaws would be compromised. When teeth are extracted and then the upper front six anteriors are retracted, the skull becomes jammed. Since the sutures, spaces between the skull bones, are viable structures (nerves, blood vessels and fibers) the contents become compressed creating neurologic (potential for chronic pain) and structural problems (scoliosis, disc compression and herniation).”

TEETH EXTRACTIONS (continued)

- For some patients, extraction of selected teeth is needed to retract protruded teeth into the extraction spaces.

- Why extract the first bicuspids? Because the space created is closest to the teeth to be retracted (the anterior 6).

- Orthodontists are reluctant to recommend extractions and would prefer to treat everyone on a non-extraction basis, but this is not realistic and will not satisfy patient complaints of extreme protrusion of teeth and lip incompetence.

- Treatment decisions are made after careful consideration of all records, including cephalometric measurements, and with particular consideration for patient concerns and the desire to have a pleasing smile and facial profile.
DID YOU KNOW?

- The relapse rate in non-extraction (expansion of the dental arches) treatment is as high as in extraction treatment.
- When a patient is treated by expanding the dental arches who should have had teeth extracted, the maxillary arch can become so enlarged that fenestrations appear in the buccal sulcus (that is, the roots of maxillary molars break through the bone on the cheek side of the alveolar bone above the molars).

TO EXTRACT OR NOT

- With attention paid to the concerns and desires of each patient, and careful evaluation of orthodontic records, a logical and correct decision can be made about whether or not extractions will be needed as a part of orthodontic treatment, on a case-by-case basis.
- As mentioned, orthodontists would rather treat patients without having teeth extracted whenever possible.

EXAMPLE OF A WOMAN WHO IS NOT A CANDIDATE TO HAVE TEETH EXTRACTED IN ORTHODONTIC TREATMENT
THE END
THE DENTAL SCIENCE UNDERLYING THE DISCIPLINE OF OROFACIAL MYOLOGY

PURPOSES OF PRESENTATION

- To describe the dental science that defines the discipline of orofacial myology.
- NOTE: Orofacial myology is an area of specialization within dentistry and speech pathology rather than being a separate profession.
- To provide clinical perspectives and guidelines regarding the information presented.

THE IMPORTANCE OF THIS PRESENTATION

My opinion: Knowing the information to follow is critical to your becoming an excellent clinician and a representative of the field of orofacial myology.
WHAT DISTINGUISHES OROFACIAL MYOFUNCTIONAL THERAPY FROM DENTAL/ORTHODONTIC TREATMENT?

-Dentists and orthodontists focus primarily on teeth-together relationships.
-Orofacial myologists treat teeth-apart postures and behaviors.
-This difference distinguishes the muscle retraining work of the OFM from the dental-occlusal and jaw manipulations of dental/orthodontic providers.
-This difference is an excellent way to market yourself to referral sources and the public.

MYTHS THAT HAVE BEEN DEBUNKED

SOME OF THE MYTHS:
-Tongue thrusting represents an “orofacial muscle imbalance”.
-Individuals swallow 2,000 times per day (really – 800 to 1000).
-A tongue thrust swallowing involves “excessive pressure” on the front teeth (1-7 pounds).
-Swallow pressures add up.
-Tongue thrusting is a primary cause of malocclusion.

( NOTE: The “myths” article is available to you on the website at the link: http://orofacialmyology.com/StatementsGuidelines.html)

WHERE DID THESE MYTHS ORIGINATE?

- Mostly from a few orthodontists who, early on, (50+ years ago) had an interest in tongue thrust; primarily Walter Straub.
- They did not have access to instrumental approaches to studying tongue thrusting.
- Later, Mr. Daniel Garliner popularized the incorrect claims.
DATA-BASED STUDIES IN DENTAL SCIENCE THAT HAVE
CLARIFIED THE FALSE CLAIMS

- Research findings and clinical perspectives in dental
  science/orthodontics have dispelled false claims about “tongue
  thrusting”. These classic studies were accomplished 50 years ago.
- Dr. William “Bill” Proffit’s classic series of studies using oral pressure-
  transducers continue to stand today as valid clinical studies.
- The biochemical studies of the periodontal membrane apparatus by
  orthodontist and biochemist Zeev Davidovich have contributed
  importantly to our understanding of how teeth are moved by force
  applications against them. These studies have also validated the tenets
  of orthodontic treatment.
- The findings from these studies serve as primary tenets of the field of
  orofacial myology (as elucidated in the Hanson and Mason text, 2003).

PERSPECTIVES IN DENTAL SCIENCE REGARDING OMD’S

- The importance of William R. Proffit, DDS, PhD, Orthodontist and
  Physiologist:
  - Researcher (including heading NIDR/NIH section)
  - Author (over 200 articles, 80 book chapters 10 books)
  - World teacher and continuing education provider
  - Academic leader in orthodontics (self-study modules)
  - Genius IQ – highest score on orthodontic boards ever!
  - Just awarded the first Lifetime Achievement Award for Orthodontic
    Research
- (I recommend that you purchase a used copy of the Proffit et al text,
  Contemporary Orthodontics, a very useful resource of information for
  orofacial myologists).

DISCLAIMER: I WAS PRIVILEGED TO BE A PART OF PROFFIT’S TEACHING AND
RESEARCH TEAM AT U-K, (LEXINGTON). I ALSO RECEIVED MY ORTHODONTIC
RESIDENCY TRAINING IN PROFFIT’S PROGRAM AT UNC (CHAPEL HILL)

(A COPY OF THIS HISTORICALLY-SIGNIFICANT PUBLICATION IS PROVIDED FOR YOU)
WHAT EVERY OROFACIAL MYOLOGIST SHOULD KNOW – THE SCIENCE THAT DEFINES THE DISCIPLINE

FIRST, FACTS AND PERSPECTIVES FROM ORAL PRESSURE TRANSDUCER STUDIES BY PROFFIT ET AL
SECOND, FINDINGS FROM BIOCHEMICAL STUDIES OF THE PERIODONTAL MEMBRANE APPARATUS BY DAVIDOVICH AND COLLEAGUES.
FINALLY, MY OWN APPLICATION OF CONCEPTS REGARDING THE FREEWAY SPACE AND CLINICAL APPLICATIONS TO OMT THEORY AND CLINICAL PRACTICES.

IBM HEAD ENGINEER BOB PATTERSON (left) and ORTHODONTIST/PHYSIOLOGIST WILLIAM “BILL” PROFFIT

AN INTRAORAL TRANSDUCER
CALIBRATION OF A TRANSDUCER

HARD PALATE APPLIANCE IN PLACE
WITH 5 TRANSDUCERS

APPLIANCE COVERING LOWER ANTERIOR TEETH TO
DOCUMENT RESTING AND FUNCTIONAL LIP PRESSURES
APPLIANCE TO DOCUMENT LIP PRESSURES

APPLIANCE TO DOCUMENT RESTING AND FUNCTIONAL TONGUE PRESSURES AT THE LINGUAL OF THE LOWER DENTITION

TRANSDUCER RECORDINGS

Transducers can be located anywhere desired in the oral cavity.
Transducers have recorded pressures from many locations, especially from 5 locations on the hard palate, including the “spot”, and from the facial and lingual surfaces of anterior and posterior teeth.
Measurements were made of lip and tongue pressures with patients “at rest”, and during speaking and swallowing tasks.
SUBJECT TESTING WAS DONE IN A SOUND-PROOF ROOM, ON-LINE TO A COMPUTER, WITH A STANDARDIZED MOUTH-TO-MICROPHONE DISTANCE MAINTAINED.

PEER REVIEW

- The transducer research involved federal grant support and rigorous peer review by NIDR.
- All studies were also subjected to peer review through convention presentations at:
  - International Association for Dental Research (IADR), Acoustical Society of America, AAO, and ASHA.
- All publications are in peer-reviewed journals.
- The equipment developed and used, and data collected, stand today as exemplary, well-controlled clinical studies in orthodontics and speech science, and are considered to be classic studies in dental science.
- (Dr. Proffit and students have since used the pressure transducers to document many factors associated with the eruption of teeth).

RELATED STUDIES:
ORAL PRESSURE AND ORAL CAVITY SIZE
CEPH MEASURES OF ORAL CAVITY DIMENSIONS

DID YOU KNOW THAT YOU ARE EITHER RIGHT OR LEFT TONGUED IN SPEAKING AND SWALLOWING? HERE IS A PATIENT’S “RIGHT-TONGUED” SALIVA SWALLOW PRINTOUT From McGlone and Proffit, 1973

A SWALLOW BY A RIGHT-TONGUED ADULT LISPER McGlone and Proffit, 1973
Individuals are either right or left-tongued in speaking and swallowing. There is no correlation between handedness and tonguedness.
CHILDREN'S SWALLOWS

Children's swallows are characterized by variability, one from the next.

CHILDREN’S “TRANSITIONAL” SWALLOW PATTERNS

There are as many as 10 transitional swallow patterns that children pass through from infancy to an adult swallow.

Changes in swallow patterns are apparently related to oropharyngeal development. (Mason and Proffit)

MORPHOLOGICAL AND NEUROMOTOR CHANGES THAT ACCOUNT FOR TRANSITIONAL SWALLOW PATTERNS

(Dr. PROFFIT’S AND MY VIEWS)

1. Changes in the airway ~ size of tonsils and adenoids.
2. Differential growth of the tongue ~ the tongue grows faster than the mandible to which it is attached.
3. Height of the mandibular ramus and posterior tongue.
4. Length of the soft palate.
5. Dental eruption and exfoliation.
6. Neuromotor maturation
Swallowing therapy for children should be prescribed based on presenting morphology and neuromotor capability (or deficit) rather than attempting to impose an adult swallow pattern on a child.

Most children swallow the best way they can. In many instances, there are reasons not to try to modify the swallow pattern (such as...?). The point is: evaluate the patient’s structures and capabilities/deficits. Oral diadochokinesis is a key diagnostic procedure.
A NORMAL ADULT SWALLOW

ADDITIONAL INSIGHTS FROM ORAL PRESSURE TRANSDUCER STUDIES:
ADULT SWALLOWING PATTERNS

Adult swallows are stable and highly predictable in pressure pattern and maxillary contact area.

HORIZONTALLY-DIRECTED TONGUE PRESSURES DURING SWALLOWING

Horizontally-directed tongue pressures during swallowing are insufficient in force and duration to displace teeth.
TONGUE THRUST PRESSURES AGAINST THE INCISORS

The amount of pressure generated against the upper incisors by a tongue thrust swallow can approach 75 gm/cm², but is usually between 25-50 gm/cm².

A tongue thrust swallow definitely does not produce pounds of pressure against the teeth.

(A reminder – there are 454 grams in a pound)

CLINICAL INSIGHT

If a tongue thrust swallow was a primary factor in moving teeth into malocclusion, wouldn’t you expect to see anterior spacing, mobility of anterior teeth, root resorption, and flaring of incisors?

You don’t!

VERTICAL TONGUE PRESSURES DURING SWALLOWING

Vertically-directed tongue pressures during swallowing decrease with the magnitude of an open bite.
SWALLOWING AND THE POSITION OF TEETH

Tongue and lip pressures during swallowing do not correlate with the position of teeth.

WHY ISN’T TONGUE THRUSTING A PRIMARY MOVER OF TEETH?

The answer lies in understanding those factors contributing to “dental equilibrium” (to be described in detail ahead).
**THE IMPORTANCE OF THE DURATION OF ANY FORCE APPLICATION AGAINST TEETH**

As mentioned, the duration of tongue and lip pressures during swallowing are insufficient to create dental changes.

**CLINICAL APPLICATION**

Since the pressures from swallows do not add up over time, the number of swallows per day are of no consequence. Why? Because any short-acting force application against the dentition and supporting periodontium results in the periodontal membrane apparatus rebounding quickly to such forces applied, restoring the equilibrium involved. (I will repeat this shortly in additional detail).

(REVIEW: the periodontium includes the investing and supporting tissues surrounding each tooth; namely, the periodontal membrane, the gingiva, and the alveolar bone).

**RESTING TONGUE AND LIP PRESSURES**

In the horizontal plane, resting tongue and lip pressures do not balance over time. There is never any balance of tongue and lip muscle pressures.
TONGUE AND LIP PRESSURES NEVER BALANCE
(from Proffit, 1978)

THE HORIZONTAL PLANE – NEVER ANY MUSCLE BALANCE

WHY, FOR SOME, IS THERE A FORWARD REST POSTURE OF THE TONGUE?

A forward rest posture of the tongue – can be an adaptation to airway issues (including allergies), habits, and/or a deficit in oral development status.

The two main causes of a forward rest posture and tongue thrust are: **prolonged sucking habits** and **unresolved airway problems**.

(Dr. Honor Franklin insists that all of her patients undergo an airway analysis by an ENT and allergist, and have any airway interferences resolved prior to the initiation of OMT).
HOW DOES AN INTERDENTAL TONGUE POSITION LEAD TO AN OPEN BITE?

THE CONCEPT OF DIFFERENTIAL DENTAL ERUPTION

- Teeth can erupt throughout life, under specific conditions.
- In a child, when the mandible is hinged open by a forward (interdental) rest posture of the tongue for hours per day, additional posterior maxillary eruption and vertical drift is re-initiated, but anterior eruption is inhibited.
- Maxillary posterior teeth overerupt and the alveolar bone follows along by a process of vertical drift. At the same time, the anterior teeth do not erupt further.
- Vertical drift is why the maxillary posterior teeth do not erupt out of their sockets: the supporting bone follows along the additional eruption process.
- All of this occurs only if the vertical dimension (freeway space) is maintained open in an abnormal position for hours per day.

VERTICAL ERUPTION FORCES

- It only takes @15 gr/cm² of continuous (resting) pressure to inhibit eruption of anterior teeth.
- For posterior teeth, the figure is @35 gr/cm².
- As mentioned, duration of pressure is key.
- Only light intermittent or continuous pressures are needed to move teeth.
DIFFERENTIAL DENTAL ERUPTION:
NORMAL PATHWAYS OF DENTAL ERUPTION

- Maxillary posterior teeth erupt downward and forward.
- Mandibular posterior teeth erupt primarily upward.
- Differential eruption patterns explain, in part, the development of Class II and III malocclusions.

ERUPTION PATHWAYS AND DIFFERENTIAL ERUPTION OF TEETH

THE CONSEQUENCES OF OMDs
AS EXPLAINED IN INVITED EDITORIAL TO ENT SPECIALISTS:
(A COPY OF THIS EDITORIAL IS ON THE WEBSITE)

The consequence of a freeway space open beyond the normal range for 6 or more hours per day due to airway interferences or allergies can result in changes to the dentition that can take three basic forms:

1. When the tongue assumes a forward, interdental rest posture with mandible hinged open, posterior teeth can over-erupt while anterior teeth are inhibited from further eruption because of the interposed tongue. This process is known as “differential dental eruption”, the result of which is an anterior open bite.
2. The second scenario of additional, unwanted dental eruption with the mandible hinged open, occurs when the tongue at rest is splayed over the occlusal surface of all mandibular teeth. In this scenario, upper teeth can continue to erupt downward and forward, following their normal curvilinear path of eruption while the lower teeth do not undergo any further vertical eruption. The result is the development of a Class II malocclusion with maxillary incisor protrusion.

(From Mason and Franklin: Orofacial Myofunctional Disorders and Otolaryngologists. Otolaryngology. October, 2014)
(3) In the third scenario, the mandible is habitually hinged open and the blade of the tongue follows the mandible and is repositioned inferiorly. When this occurs, the tongue loses the normal balancing and opposing pressure relationship with the cheek muscles in maintaining the position of the maxillary posterior dental arches. The buccinator complex of cheek muscles become more activated when the tongue is repositioned inferiorly with the mandible. Over time, the maxillary posterior dental arch narrows to create a posterior maxillary crossbite. The hard palatal vault may also appear to be heightened as the maxillary lateral dental arches are displaced downward along with the narrowing of the maxillary posterior arch segments.

(From Mason and Franklin: Orofacial Myofunctional Disorders and Otolaryngology, Otolaryngology, October, 2014)

CONSEQUENCES OF OMDs (CONTINUED)

When unwanted additional dental eruption occurs as in scenarios (1) and (2), the roots of teeth are not further exposed during the over-eruption process because the supporting alveolar bone follows along. This process is termed “vertical drift” of alveolar bone. With the mandible habitually hinged open, changes in facial and oral structures can develop that may include, variably, a high and narrow hard palatal vault, posterior dental crossbite, a recessed chin, mandibular retrognathia, a short upper lip, lip incompetence, and hyperactive/strained mentalis muscle activity.

Conversely, some patients have a habit pattern of clenching that involves keeping the bite closed for hours per day. Closure of the normal freeway space for extended periods can lead to dental trauma and dysfunction of the temporomandibular joint apparatus. Altogether, a change in the normal resting dental freeway space, either too far open or closed, can create negative consequences in dental eruption or the position of teeth.

(From Mason and Franklin, Otolaryngology, October, 2014)

EQUILIBRIUM THEORY

(ADMITTEDLY, THIS CAN BE A DIFFICULT CONCEPT TO UNDERSTAND)
WHAT ACCOUNTS FOR DENTAL EQUILIBRIUM?

Fact: Teeth are subjected to a variety of forces in multiple directions yet remain stable in their positions in the dental arch.

By definition, an equilibrium exists when a body at rest is subjected to forces in various directions, but is not accelerated (that is, teeth tend to remain where they are — whether in normal occlusion or in malocclusion).

DURATION OF FORCE APPLICATIONS

During mastication, not only do the teeth move slightly, but the alveolar bone and basal bone of the maxilla and mandible bend and flex.

These changes occur in a matter of seconds, and the teeth and jaws are restored to their original positions as quickly as they were displaced.

Conclusion: The dental apparatus is well-adapted to resist forces such as those generated during chewing, speaking, and swallowing where the duration of force application is typically one second or less.

(Proffit and Fields, 2000)

WHAT ARE THE PRIMARY FACTORS THAT CREATE DENTAL EQUILIBRIUM?

The major factors in establishing a dental equilibrium appear to be biologic activity created within the periodontal membrane space, along with resting pressures of the tongue and lips.

The control over the vertical dimension at rest (freeway space) also plays an important role via the masseter and temporalis muscles of mastication.
COMPONENTS OF DENTAL EQUILIBRIUM

- When you envision "dental equilibrium", think of the periodontal membrane space as the primary controlling mechanism, with important contributions from the vertical plane of space and two (paired) muscles of mastication.
- (the freeway space is a vertical component of the equilibrium control system).
- Respiratory needs can alter the equilibrium; and the tongue will adapt to maintain the airway.

THE BIOLOGY OF THE PERIODONTAL MEMBRANE SPACE

From: Bateman and Mason
APPLIED ANATOMY AND PHYSIOLOGY OF THE SPEECH AND HEARING MECHANISM, 1984

WHAT GOES ON IN THE PERIODONTAL MEMBRANE SPACE THAT WILL LEAD TO THE MOVEMENT OF TEETH?

- For movement of teeth to occur, a significant amount of cyclic adenosine monophosphate (cAMP), needs to be built up in the periodontal membrane space. (That enzyme is the primary trigger needed for tooth movement to be initiated).
- Other enzymes such as adenyl cyclase also play a role to trigger biologic activity and tooth movements.
- Increased levels of cAMP appear after about 4 hours of sustained pressure.
- (from biochemical studies of Davidovitch and Shamfied, 1975)
THE BIOLOGY OF THE PERIODONTAL MEMBRANE SPACE

- A removable appliance wearing time of 4 hours is needed to produce...
- Orthodontic theory contends that the movement of teeth with fixed or...
- The threshold for initiating tooth movement is 6 hours of sustain...

CAMP AND ADENYL CYCLASE SERVE AS TRIGGERS FOR CELL TURNOVER IN THE PERIODONTAL MEMBRANE SPACE

SUMMARY OF BIOCHEMICAL STUDIES OF DENTAL EQUILIBRIUM

- The research of Davidovitch and colleagues substantiates the long-held perspective in orthodontics that:
- A force of many hours per day is necessary to accomplish tooth movement — whether by a fixed or removable appliance.
- The duration of the forces involved in thrusting movements of the tongue are insufficient to generate the buildup of cellular changes necessary to accomplish tooth movement;
- However, an abnormal resting tongue posture can change the position of teeth if light postural pressures continue for hours per day.
THE APPLICATION OF THE FREEWAY SPACE TO THE GOALS OF OROFACIAL MYOFUNCTIONAL THERAPY

- To understand the importance of this to orofacial myofunctional therapy, we need to discuss vertical eruption and the dental **freeway space**.
- This is extremely important to know since a primary goal of your therapy will hopefully be to restore a normal resting dental vertical dimension, or freeway space.
- (I hope to make the clinical applications very simple at the end of this discussion).

QUESTION

- Why do you think it is that dentists, orthodontists, and orofacial myologists have, for so many years, focused on tongue thrusting and have ignored the importance of the rest posture until Dr. Proffit began reporting on rest posture starting in the 1970's, and in articles and texts since then?
- FYI: I introduced the importance of the freeway space to OMDs in the Hanson and Mason text (2003) and have discussed the concept in many articles since then.
- We should now know how to establish and maintain dental stability with OMT following orthodontic treatment.

THE FREEWAY SPACE (OR VERTICAL REST POSITION, OR INTEROCCLUSAL CLEARANCE)
(SOURCE: SICHER AND DUBRUL, ORAL ANATOMY, 5TH EDITION, 1978)

The normal interocclusal (freeway) space is 2-3 mm at the molars, and 2-5 mm at the incisors.
ANOTHER VIEW OF THE VERTICAL, INTEROCCLUSAL REST DIMENSION (THE FREEWAY SPACE)
2-3 mm AT THE MOLARS, 2-5 mm AT THE INCISORS

DETAILS ABOUT THE FREEWAY SPACE

In the rest position, teeth are not in contact.
The space between upper and lower teeth is called the interocclusal clearance.
In this position, the lips are lightly in contact.

THE COMMON DENOMINATOR FOR OROFACIAL MYOFUNCTIONAL DISORDERS (OMD’S)

Myofunctional disorders (tongue thrust, anterior rest posture, finger and thumb sucking habits, and lip incompetence) have in common an increase in the freeway space.
Whether it involves:
Hinging the mandible open beyond the normal interocclusal distance, or:
Clenching/closing the bite for hours per day.
A disruption of the normal resting dental freeway space, either too far open or closed, can lead to negative consequences in dental eruption and the position of teeth.
A PRIMARY GOAL OF OROFACIAL MYOFUNCTIONAL THERAPY

A rest position of the mandible that is habitually open beyond the normal range causes the initiation of additional, unwanted dental eruption that can lead to an anterior open bite by the process known as “differential eruption”.

By contrast, a vertical dimension that is over-closed for hours per day leads to dental trauma and pain.

A major goal of orofacial myofunctional therapy should be to reestablish and stabilize a normal vertical rest dimension, or freeway space. (Mason, IJOM, 2005)

ILLUSTRATION: THE RESULT OF DIFFERENTIAL ERUPTION FOLLOWING AN HABITUAL INTERDENTAL TONGUE REST POSITION

(ADDITIONAL, UNWANTED ERUPTION OF MAXILLARY POSTERIOR TEETH, WITH NO ADDITIONAL ERUPTION OF ANTERIOR TEETH)

CORTICAL CONTROL OF THE FREeway SPACE

The freeway space dimension, (the vertical inter-occlusal rest position), has a cortical control loop that includes:

- Feedback from the periodontal membrane space sent over the sensory branches of the trigeminal nerve (mandibular division) to:
  - The semilunar ganglion, then on to:
  - The trigeminal nucleus in the brain stem (pons), then back via:
  - The motor branches of the trigeminal nerve to the muscles of mastication, teeth and palate.

- Two muscles of mastication (masseter and temporalis) “report” changes in the freeway space via the feedback loop to the brainstem)
THE MASSETER AND TEMPORALIS MUSCLES
(THE MASSETER IS THE PRIMARY CONTROLLER OF THE FREEWAY SPACE)

NEUROMUSCULAR MECHANISMS OF JAW MOVEMENTS

● The descending pathways from the higher brain centers are not always similar.
● This suggests that there is a separate neural system for the jaw and tongue.

(source: Y Kawamura, JADA, May, 1961, 545-551)
INTERESTING CHARACTERISTIC OF THE MUSCLES OF MASTICATION: NEUROMUSCULAR SPINDLES

The presence of neuromuscular spindles in the medial parts of the muscles was documented by Lennartsson (J. of Anatomy, March, 1980).

- Masseter – 110 spindles
- Temporalis: 75 spindles
- Medial pterygoid – 25 spindles
- Lateral pterygoid and posterior digastric – none.

HOW IS THE FREEWAY SPACE MEASURED?

There is a detailed description of this on the website www.OrofacialMyology.info.

- Measurements are made externally from the base of the nose to the chin.
- Measuring the freeway space is only suggested for clinical record keeping or clinical research purposes.

THERAPY FOR THE FREEWAY SPACE

- Achieving a closed-lip rest position is a first step (if the airway is clear).
- With lips together, a patient can be asked to close/bite the teeth together and then slightly release the teeth-together position – with lips remaining together.
- If needed, a hard acrylic niteguard can also identify for a patient where the rest position should be.
THE ROLE OF TONGUE THRUSTING

A tongue thrust is an opportunistic response (Mason, 2003) to an increase in the freeway space and open spaces in the dentition. The tongue migrates to open positions in the dentition; that is, the open space was there first.

BOTTOM LINE ABOUT TONGUE THRUSTING

- There is much evidence that tongue thrusting does not contribute to the movement of teeth; nor is there any credible evidence that thrusting affects the position of teeth, but it may possibly contribute slightly to making the malocclusion worse.
- Very light resting tongue pressures can influence vertical tooth eruption and result in malocclusion - both open bite and excessive overjet.
- However, tongue thrust pressures are not significant.
- Conclusion: When tongue thrusting occurs with a rest position open beyond the normal range, both patterns should be eliminated by MFT.

ORTHODONTIC “RELAPSE”

“The term ”relapse” as applied to post-orthodontic changes has taken on a very meaning (from Mason: ORTHODONTIC PERSPECTIVES ON OROFACIAL MYOFUNCTIONAL THERAPY.))
FACTORS CONTRIBUTING TO POST-ORTHODONTIC RELAPSE
AND RECURRING TONGUE THRUST
(KNOW THIS LIST TO BE PREPARED!)

- poor resting relationship of lower lip to upper incisors
- incisors expanded forward during treatment
- intercanine width expanded during treatment
- late growth into open bite
- unresolved issues involving the airway
- abnormal rest posture of the tongue
- a freeway space habitually open beyond the normal range

(Sources: data from Dr. Richard Reidel and The University of Washington Orthodontic Department; also from Dr. William Proffit and Dr. Robert Mason)

ORTHODONTIC CONCERNS ABOUT POST-ORTHODONTICS RELAPSE
HERE’S WHAT YOU CAN OFFER!
KNOW THIS!

- If, following orthodontic treatment, there is a lips-together rest posture and a normal vertical dimension (freeway space), dental relapse will not occur (related to the tongue) whether or not the individual has a retained tongue thrust during speech or swallowing.

- Your treatment of post-orthodontic patients should focus on achieving and stabilizing a lips-together rest posture and a normal freeway dimension.

- Hey! What about tongue thrusting? Working to eliminate tongue thrusting during speech and swallowing, to achieve cosmetic improvement, or for any other reasons is fine, but thrusting is not the cause of orthodontic relapse, as many, perhaps most dentists and orthodontists may continue to think.

THE END
(HAS THIS BEEN LIKE PULLING TEETH?)
It is fortunate that the majority of the nasal septum (especially the anterior portion) is made of cartilage; otherwise, each of us would have broken our nose many times by now.

Illustration from: Jacob and Francone, Essentials of Anatomy and Physiology, 1976.
POSTERIOR VIEW OF NASAL CAVITY AND POSTERIOR CHOANAE
(the posterior opening into the nasal cavity)

THE NASAL CAVITY AND NASAL PHYSIOLOGY

Functions: to warm and filter air
- The epithelial lining is mucous membrane, richly supplied with blood vessels that function as a radiator, warming inspired air.
- The conchae greatly increase the surface area available for radiant activity.
- Mucus is secreted by the lining which moistens inspiratory air.
- Humidified air is essential for normal laryngeal functions.
- The nasal cavities provide a filtering activity for the respiratory tract.
- Lysozymes, a family of enzymes and part of the immune system, provide a form of protection from pathogens.
- The olfactory system receptors reside at the top of the nasal cavity.

WHAT ABOUT NASAL LAVAGE (WASHING/IRRIGATION)?

- What are the purposes of nasal washing/irrigation?
- Should an OFM include nasal washing/irrigation in their therapy? (No!)
- A physician’s response to an OMT engaging in nasal irrigation with patients: “Not with my patients”!!
CLINICAL APPLICATIONS

● As an OFM, you should not diagnose or treat any condition related to the nasal cavity. Any problems noted will require a medical diagnosis.
● As an OFM, you should not disturb the chemical activities in the nasal cavity.
● Anything you insert into the nose past a nostril is considered an invasive procedure.
● However, you can instruct and remind a patient to blow his/her nose if they have poor nasal hygiene (a common problem in children, along with poor oral hygiene).

RECOMMENDATIONS

● OFM’s should not engage in nasal lavage.
● OFM’s should refrain from putting anything into a patient’s nasal cavity.
● This recommendation is made for the protection of clinician and patient.
● There is a big difference between what a patient does to him/herself and what you do to him/her.
● For SLP’s, the ASHA Preferred Practice Patterns document does not include the nasal cavity as an area appropriate for you to evaluate and treat; however, those SLP’s with appropriate training can perform nasendoscopic evaluations in medical settings.

WHAT ABOUT LIP TAPING AND THE AIRWAY?

● Lip taping assumes, often incorrectly, that the airway is clear.
● It also assumes that if the airway is clear, it will remain open during the time that tape is in place.
● Lip taping can easily be interpreted by others (such as attorneys) as a hindrance to normal breathing.
● You would never want to be linked to any medical problem that a patient may develop during your therapy (that is, “do no harm”).
● Question: Is there any role for lip taping in OFM therapy? (my opinion is NO!)
GETTING SLEEPY? THE END
THE PALATES AND PHARYNX

On an recent IAOM discussion site, a colleague mentioned that a patient sent to an ENT was found by the ENT to have a submucous cleft.

Our colleague apparently did not feel that she/he should know how to identify a submucous cleft, nor assume any responsibility had that patient become persistently hypernasal if an adenoidectomy had been performed.

Thankfully, the ENT recognized the submucous cleft.

I want better than that scenario for you!

STRUCTURES IDENTIFIED

QUESTION:

- In the development of the human embryo, do the palates form and fuse together from front to back, or back to front?
A KEY THING TO REMEMBER ABOUT THE HARD PALATE:

- The hard palate acts as a platform for attachment of the soft palate.

WHAT ABOUT THE VAULT OF THE HARD PALATE

- Generally, the narrower and higher the palatal vault, the narrower the maxillary dental arch.
- The flatter the palatal vault, the wider the maxillary arch.

THE HARD PALATAL VAULT

- Generally, the narrower and higher the palatal vault, the narrower the maxillary dental arch.
- The flatter the palatal vault, the wider the maxillary arch.
THE “V” PRINCIPLE OF HARD PALATAL GROWTH

- Envision an inverted (upside down) V. During growth, bone is deposited on the inner, or oral surface, and at the same rate, removed (resorbed) on the nasal or outer surface of the V.

- The V moves downward and outward at the same time. This increases the overall dimension and widens the maxillary dental arch because movement is toward the wide end of the V.

HARD PALATAL GROWTH – THE “V” PRINCIPLE
(Enlow and Hans, 1996)

HOW THE HARD PALATE GROWS:

- You may be surprised to learn that the tongue does not “mold” the hard palate, as is a common but incorrect view.

- In fact, the hard palate forms by growth factors controlled above the hard palate rather than below it.

- The configuration of the cranial floor and the course and spread of olfactory nerves, and the sequential and progressive parts of component bones above the palate are a part of influencing movements that account for the shape of the hard palate.

(Details can be found on the website www.OrofacialMyology.info in the article by Mason: Myths That Persist About Orofacial Myology, IJOM, V 37, 2011)
THE ROLE OF THE TONGUE:

- Normally, lateral posterior tongue pressures exerted against the posterior maxillary teeth are met with balancing pressures from the cheek muscles, thus stabilizing the position of the maxillary posterior dentition.
- If the mandible drops down and assumes an open rest posture, with the tongue blade following along to rest low and away from the maxillary posterior teeth, the posterior maxillary arches can narrow due to unopposed pressures of the cheek muscles.
- This abnormal, low rest posture of the tongue and open mandible position can encourage maxillary posterior teeth to undergo additional downward eruption that accompanies narrowing of the maxilla.
- The result will be a perception of a high, narrow hard palate vault.

HOW WOULD YOU DESCRIBE THIS HARD PALATAL VAULT?

TORUS PALATINUS

- An extra growth of bone (a benign exostosis) that develops over the midpalatal suture of the hard palate.
- It begins to express itself in a child at around age 6 as an oval bluish coloration.
- The bluish color is thought to be the outline of the displaced blood supply at the lateral edges of the tissue proliferation.
- Frequency of occurrence: 1 in 5 individuals
TORUS PALATINUS

MANDIBULAR EXOSTOSIS

THE SOFT PALATE

- The hard palate is a bony platform that provides an attachment for the soft palate.
- The velum attaches at the posterior border of the hard palate (posterior margin of the horizontal plates of the palatine bones) along the palatine aponeurosis (known as the fibrous skeleton of the soft palate).
- The palatal aponeurosis (fibrous connective tissue) spreads throughout the soft palate back to the free border.
- When the tensor and levator muscles of the velum contract, the aponeurosis is transformed into a firm, horizontal structure that participates in closing off the nasopharynx from the oropharynx.
The soft palate has the capacity to “stretch” or elongate during elevation. This is related to the course of the levator veli palatini muscles from the palate along the lateral pharyngeal walls and angled back and upward to the medial surface of the Eustachian tube. Children with oral clefts have a reduced capacity for velar stretch. (what about patients with OMDs?) This phenomenon was first described by Pruzansky and Mason, *J. Dental Research, 1969*
REST AND PHONATION

THE UVULA

- The uvular muscle is a variably paired band of muscle fibers on either side of the midline of the nasal surface of the soft palate. (Some anatomy texts describe it as unpaired). The fibers begin at the posterior nasal spine and in the palatine aponeurosis.
- The muscle fibers course through the soft palate along the midline and insert into the uvula’s mucous membrane, ending in the uvula itself.

WHAT DOES THE UVULA DO?

- (Actually, not much!)
- Contraction of the musculus uvula shortens it and can draw the uvula up to shrink it.
- It has a doubtful possible role in swallowing (assisting the sealing process during VP closure).
- The uvula is often regarded as a degenerate or vestigial remnant; it is only present in higher mammals.
- Altogether, it has no discernible role and does not respond to exercise efforts.
INCIDENCE OF BIFID UVULA

- The incidence of bifid uvula in a normal sample is 1 in 75 individuals (Meskin, Worms and Isaacson, 1964).
- A bifid uvula can be an innocuous finding.
- The astute clinician will check for the presence of a submucous cleft when a bifid uvula is seen;
- CLINICAL GUIDELINE: when you identify a bifid uvula in a patient, consider the patient to be at risk for developing hypernasality from an adenoidectomy until you prove yourself wrong (with a lateral cephalometric radiograph taken during sustained phonation).

WHAT ABOUT EXERCISES FOR THE SOFT PALATE?

- Efforts to exercise/lengthen/strengthen the soft palate have been attempted unsuccessfully for 100 years.
- Blowing exercises have been used unsuccessfully in speech-language pathology.
- An obturator reduction program has yielded some increases in soft palatal activity (working against resistance).
- Stroking the velum, gagging, and other efforts to improve palatal elevation have failed.
- The most effective way of maximizing soft palate activity is by........

(Source: Peterson-Falzone, Hardin and Karnell, Cleft Palate Speech, 2008).

MAXIMIZING ACTIVITY AT THE ORAL ORIFICE VALVE

- There is muscle reciprocity between the anterior oral valve and the posterior sphincter (velopharyngeal mechanism).
- Exercises using exaggerated movements at the front of the mouth can maximize velar activity at the back of the mouth.
BUCCINATOR AND SUPER CONSTRICCTOR MUSCLES: CONTINUITY AT THE PTERYgomandibular RaphE

THE PTERYgomandibular RaphE: INTRAOrAL VIEW

LET'S LOOK AT SOME PALATES
WHAT DO YOU SEE?
WHAT IS THIS, AND WHAT ABOUT THE VAULT OF THE HARD PALATE?
WHAT IS A SUBMUCOUS CLEFT PALATE?

- A bony defect in the hard palate, with an intact mucosal covering,
- varying from a notching at the posterior nasal spine or extending as far forward as the incisive foramen,
- Or, a submucosal cleft of the soft palate with intact mucosa over separated muscles at the midline, with the contracted muscles taking the shape of an inverted "V", often extending into the hard palate submucosal cleft.
- QUESTION: You may find a submucous cleft of soft palate only, or one involving soft and hard palate – but not a hard palate defect only.
- Why?

SUBMUCOUS CLEFT OF HARD AND SOFT PALATE AND BIFID UVULA WITH “ZONA PELLUCIDA”

- What is that on the posterior pharyngeal wall?

PASSAVANT’S BAR (CUSHION OR PAD)

- A bulging forward of a horizontal band of superior constrictor muscle tissue on the posterior pharyngeal wall during a functional activity.
- Thought to be an adaptation for a deficient soft palate.
- However, Passavant’s pad (or cushion) is occasionally seen in normal individuals.
WIDE SUBMUCOUS CLEFT OF HARD AND SOFT PALATE

Note the muscle bundles at the margins of the cleft. Why?

NORMAL PALATES (L) AND SUBMUCOUS CLEFT PALATES (R)

The importance of the velar dimple

A VARIETY OF SUBMUCOUS CLEFTS
WHAT TO LOOK FOR INTRAORALLY TO IDENTIFY A SUBMUCOUS CLEFT

- Compare the velum at rest and during a sustained “ah”.
- During phonation, the velar dimple should be seen just above the uvula, while for a submucous cleft, it will appear much higher (farther forward) on the soft palate than just above the uvula.
- With a submucous cleft, velar muscles will course forward, showing an inverted V-shape to the velum during a sustained phonation.
- The uvula will almost always be bifid. You will see a heart shaped lower border to the uvula.

HOW TO EVALUATE FOR A SUBMUCOUS CLEFT (CONTINUED)

- If you suspect a bifid uvula, insert a tongue blade slightly past and under the uvula, raise the tail end of it, pull it slowly forward and try to “tease” the uvula tags open that are held together with mucous.
- If the coloration of the soft and hard palate midlines appears to be grey or white, with a gloved finger, palpate for the posterior nasal spine (this is rarely needed).
- With a small, thin flashlight, you can “transilluminate” the nasal cavity to look orally for a thin submucous cleft.

THE PRIMARY INTRAORAL EVALUATION GUIDELINES

- You will obtain much better information about the status of the hard and soft palates from assessing the soft palate when elevated (during a sustained phonation), rather than by trying to evaluate the velum at rest.
- Midline coloration and the location of the velar dimple are key observations to make.
- Whenever a bifid uvula is seen, be suspicious about a submucous cleft being present, until you prove yourself to be wrong.
BOUNDARIES OF THE NASOPHARYNX

- Superiorly – rostrum of the sphenoid and basilar portion of the occipital bone.
- Inferiorly – the level of the soft palate.
- Anteriorly – the posterior choanae of the nasal cavity.
- Laterally – the pharyngeal orifice of the Eustachian tube. (question: where is the widest place in the pharynx?)
- Posteriorly – the adenoid mass, or superior constrictor.

CONSTRICCTOR MUSCLES OF THE PHARYNX AND THEIR ANTERIOR ATTACHMENTS

SWALLOWING:
STAGES OF A NORMAL SWALLOW
A “SO-CALLED” ABNORMAL SWALLOW

A SWALLOW

A CLINICAL APPLICATION

CLINICAL APPLICATION: WHY A PATIENT SHOULD NOT PROTRUDE THE TONGUE WHEN YOU ARE EVALUATING VELAR ELEVATION.
(From Bateman and Mason, Applied Anatomy and Physiology of the Speech and Hearing Mechanism, 1984)
IMPORTANCE OF THE PALATOGLOSSUS MUSCLES
(From Bateman and Mason, Applied Anatomy and Physiology of the Speech and Hearing Mechanism, 1964)

MEDIAL MOVEMENT OF THE LATERAL PHARYNGEAL WALLS
Can you predict movement at the velopharyngeal sphincter from the level of intraoral inspection? (Source: Young and Mason, 1971)

LATERAL PHARYNGEAL WALL MOVEMENT IN NORMAL SUBJECTS – TRACINGS FROM CINEFLUOROGRAPHIC FILMS
THE END