OROFACIAL MYOFUNCTIONAL DISORDERS

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This article provides current information about the field of orofacial myology.

What are Orofacial Myofunctional Disorders?

Many of you may not be familiar with the term “orofacial myofunctional disorders”, often abbreviated OMDs. Orofacial myofunctional disorders include one or a combination of the following:

1. abnormal thumb, finger, lip, and tongue sucking habits
2. an inappropriate mouth-open lips-open resting posture
3. a forward interdental rest posture of the tongue
4. a lateral, posterior interdental tongue rest posture
5. inappropriate thrusting of the tongue in speaking and/or swallowing.

What are the Consequences of OMDs?

Abnormal habit patterns, functional activities, and oral postures can open the dental bite beyond the normal rest position. This can result in a disruption of dental development in children and over-eruption of selected teeth in adults (Mason and Franklin, 2014)..

Over time, dental malocclusion, cosmetic problems, and even changes in jaw growth and position are observed in some patients with OMDs. Examples of changes that can result from a chronic open mouth rest posture include an increased vertical height of the face, a retruded chin, a downward and backward growth of the lower face (rather than downward and forward), and flaccid and hypotonic lips (Proffit, 1986).

A prime example of an OMD, familiar to all pediatricians and dentists, is a retained sucking habit or use of a sippy cup. While it is tempting to ignore such habits since some children do outgrow them, many children do not spontaneously discontinue noxious habits and will need help in eliminating the habits. The behavioral approaches of the

myofunctional clinician are effective in eliminating thumb and finger and other associated sucking habits (VanNorman, 1997; 1999).

The general rule in dentistry, and affirmed in pediatrics, is that oral habits should be addressed and eliminated prior to the eruption of the adult incisors, or by age 6 (Hanson and Mason, 2003). Without habit elimination, a maxillary posterior cross bite and an anterior open bite, or other malocclusions, will likely develop. For habit patterns that may affect the developing dentition, orofacial myologists work with physicians and dentists in the selection process of children who will not outgrow an ingrained habit pattern and will need professional help in habit cessation.

Is There Commonality among OMDs?

As you read this, it is expected that your lips are closed but your teeth do not touch; that is, the normal dental rest position is characterized by a small open space between upper and lower teeth. This normal resting space, is referred to as the dental *freeway space*, or inter-occlusal space. The normal freeway dimension is 2-3 mm at the molars, and 4-6 mm at the incisors (Sicher and DuBrul, 1970).

The *common denominator* of orofacial myofunctional disorders is: all OMDs result in a change in the vertical dimension, or freeway space. An OMD, whether digit habit or altered oral posture, causes the mandible to hinge open slightly while also increasing the resting inter-occlusal space between the upper and lower jaws and teeth. Only a slight increase in resting freeway space, for hours per day, is needed to initiate continued and unwanted vertical eruption of teeth (Proffit, 1986; Mason, 1988).

Conversely, some patients have a *clenching* habit pattern that involves maintaining a closed bite 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 (Sicher and DuBrul, 1970). Altogether, a disruption of the normal resting dental freeway space, either too far open or closed, leads to negative consequences in dental eruption or the position of teeth (Mason and Franklin, 2014)..

What Can Orofacial Myofunctional Therapy Do about Freeway Space Variations?

A primary goal of orofacial myofunctional therapy (OMT) is to recapture a normal freeway space (vertical interocclusal dimension) by eliminating deleterious sucking habits, retro-positioning a forward interdental tongue posture, teaching a closed lips nasal breathing posture, retraining and eliminating a tongue thrust, or normalizing (opening) a closed dental rest posture. A variety of exercises are involved that are based on individual evaluation and treatment protocols.

A key challenge in the evaluation process is to identify the multi-factorial causes of the OMD; the primary factor being nasal airway interference linked to structural issues such as enlarged tonsils. Other causative factors include unresolved sucking habits, and airborne issues associated with allergies. A team approach to diagnosis and management of OMDs should include physicians and dentists, orthodontists, allergists, and ENT specialists.

The role of the airway

There is no controversy about the relationship of unresolved airway issues and the appearance and maintenance of oral habits patterns and postures described as OMDs. However, controversy continues concerning the overuse of the term “mouth breathing” based solely on the clinical observation of a lips-apart, mouth-open rest posture. It is now well accepted in dental science that *mouth breathing* is a *physiologic term* that should reflect, in most instances, the results of an aerodynamic assessment of the airway (Warren & DuBois, 1964; Watson, Warren & Fischer, 1968). There is poor relationship between a child's facial appearance and a mouth breathing habit (Vig et al, 1981). A careful assessment of the airway is needed to confirm a diagnosis of mouth breathing (Mason & Riski, 1983; Riski, 1983).

It is well known that many children have poor oral hygiene. It is not well known, however, that many children also have poor *nasal* hygiene. Aerodynamic assessments of the airway have confirmed poor nasal hygiene in children suspected of being mouth breathers.

The simple task of blowing the nose has been shown to reduce nasal airway resistance by up to 50% and, in many cases, has served to eliminate the facial posturing perceived to be mouth breathing (Hanson and Mason, 2003).

True instances of mouth breathing link demonstrable airway interferences with tongue postural and functional activities. Enlarged tonsils and adenoids, allergic rhinitis, and growth variations in the orofacial and pharyngeal complex of structures can influence oral behavioral and postural adaptations. A tongue forward rest posture, or a tongue thrust swallow, serve as a *clue* to evaluate the posterior airway for some unresolved airway issue. Tongue thrusting and abnormal tongue posturing may signal the presence of a retained sucking habit.

Orofacial-pharyngeal-nasal airway interferences should be evaluated and resolved before myofunctional therapy is initiated. The interdisciplinary impact of airway interferences will involve physicians and dentists in collaborative diagnostic and treatment planning procedures with orofacial myologists.

How Does Orofacial Myofunctional Therapy (OMT) Differ from Dental Treatment?

While the theoretical tenets of OMDs are derived from dental science, OMT is not dental treatment. An important distinction between dentistry and orofacial myology should be recognized: ***Dentists and orthodontists are primarily concerned with teeth-together relationships, while orofacial myofunctional clinicians are concerned with teeth-apart postures and behaviors***. This distinguishes the muscle retraining work of the OMT from the dental-occlusal and jaw manipulations of dental/orthodontic providers. It also highlights how therapy procedures aid in the creation or restoration of an oral environment and appropriate vertical rest dimension of the jaws in which normal processes of dental development can occur (Mason, 2005).

Controversies involving OMDs

You may have been exposed to misconceptions about OMDs that

have been perpetuated over the past 50 years. Some examples of ***inaccurate*** perceptions include:

- *Tongue thrusting is a primary cause of dental malocclusion*. This is incorrect. Actually, thrusting is an *adaptation to* rather than a cause of malocclusion (Proffit, 1973).
- *People swallow 2,000 times per day*. Actually, the mean number of swallows per day for adults is 585, while for children, the range is from 800 to 1,000 (Flanagan, 1964; Lear, Flanagan, and Moorrees, 1965).
- *A tongue thrust swallow represents an excessive* pressure (1-7 pounds per swallow). Swallow pressures average @ 50 grams/cm^2 (Proffit, 1973). You will recall that there are 454 grams in a pound.
- *The pressures generated by swallows add up or compound throughout the day*. This is incorrect; they do not.
- *A tongue thrust represents an orofacial "muscle imbalance."* No muscle balance ever occurs between the tongue and lips, so the notion of a patient having muscle "imbalance" as a reason for initiating therapy is misleading and incorrect (Proffit, 1978)

Important note: The misconceptions cited above represent an incorrect perception of functional activities of the tongue occurring in the horizontal plane. Many clinicians have, historically and inaccurately, envisioned the teeth being positioned in the middle of a muscle force field, with the muscles of the tongue on one side, and the opposing and balancing muscles of the lips and facial expression on the other.

It has been difficult for some clinicians to perceive how dental stability, or lack of, is primarily **controlled in the vertical** rather than horizontal dimension. A key to understanding how the vertical dimension influences the horizontal is to add hours per day (*duration*) to this equation; that is, vertical changes that influence the horizontal plane with OMDs take place over time, hours per day, while the short

bursts of a horizontally-directed tongue thrust swallow or thrusting during speech lack the *duration* to account for dental changes.

In children with an OMD, a rest posture with tongue forward and lips apart opens the freeway space beyond the normal range, hours per day, and triggers vertical eruptive activity that can result in a malocclusion such as an anterior open bite. When a rest posture variation is present for hours per day, unwanted changes in the dentition are seen.

A Myofunctional View of the Tongue

Various applications of “functional appliances” in orthodontics have been documented in the orthodontic literature. Removable appliances designed to influence jaw growth and dental eruption have been developed. One such appliance is the “activator.” Harvold (1974) used an activator appliance to change the “functional occlusal plane” in the correction of certain malocclusions.

The *functional occlusal plane* represents the functional table of posterior occlusion, the level and inclination of which is the result of neuromuscular, growth and developmental forces acting on the dentition (Harvold, 1974). **In normal dental eruption, maxillary posterior teeth follow a downward and forward curvilinear path, while mandibular posterior teeth erupt vertically in harmony with the vertical growth of the lower face** (Woodside, 1977).

Manipulation of the functional occlusal plane with an activator appliance can be accomplished by changing a Class II malocclusion into a normal Class I occlusion by inhibiting the eruption of maxillary posterior teeth and permitting the mandibular posterior teeth to continue to erupt vertically. An activator appliance can also change a Class III malocclusion to Class I by inhibiting mandibular posterior dental eruption and encouraging maxillary downward and forward dental eruption (Harvold, 1974).

An important concept and clinical reality that deserves recognition is that **a forward, interdental rest posture of the tongue can act as a**

functional appliance by opening the freeway space and encouraging *differential dental eruption*, leading either to an anterior open bite or a Class II division 1 malocclusion. The term “differential eruption” denotes a situation in which unwanted posterior dental eruption is encouraged by opening the freeway space beyond the normal range, while at the same time, anterior dental eruption is inhibited by a resting interdental tongue posture; hence, the additional posterior eruption and inhibited anterior eruption are described in dental science as a combined process of differential vertical eruption of teeth.

When the tongue creates a myofunctional disorder by habitually protruding between the incisors, with the mandible hinged open beyond the normal range, an anterior open bite and Class II malocclusion can develop (Proffit, 1986, Alexander, 1999).

By contrast, in a Class III occlusion, if the tongue margins at rest splay laterally over the occlusal surfaces of all lower teeth, this rest position of the tongue will create continued vertical eruption of maxillary teeth while the lower teeth are impeded in eruption by the resting tongue. Over time, a Class I occlusion can develop. The differential eruption caused by the resting tongue posture is another example of the tongue serving as a functional appliance.

The concept that **the tongue can act as a functional appliance** is a tenet of orofacial myology and one which is compatible with current orthodontic theory and experience with various functional appliances.

What Then Is the State-of-the-Art Regarding OMDs?

Tongue Thrusting

This lingual functional pattern has been inappropriately highlighted in the past. Some conclusions about swallowing and tongue thrusting are derived from the research of Proffit and colleagues using miniature pressure transducers placed in carrier appliances fit over the teeth and on the hard palate (see References under Pressure Transducer Studies).

- *Children are either right-tongued or left-tongued in speaking and swallowing*. Typically, the back of the tongue only (not the tip) on one side contacts the maxillary posterior teeth or the supporting alveolar bone during saliva swallowing. This posterior "sidedness" preference is noted in the production of /s/ sounds that normally involve a movement or positional sensation with the tongue tip elevated. The back of the tongue acts as a hinge to direct and stabilize the tongue tip to some arbitrary vertical position. Of interest - there is no correlation between tonguedness and handedness.

- *Children's saliva swallows are characterized by variability from one swallow to the next.*

- *There are as many as 10 transitional saliva swallow patterns from an infant swallow to an adult swallow.* Changes in saliva swallows are related to oropharyngeal development. Morphological influences that may account for the transitional swallow stages in children include: (1) changes in the airway—size and growth 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; and (6) neuromotor maturation (Mason, 1988).

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

- *Horizontally-directed tongue pressures during saliva swallowing are insufficient in **force** and **duration** to displace teeth*. The amount of pressure against the upper incisors during a swallow for a tongue thruster is usually between 25-50 grams/cm2 (Proffit, 1973).

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

- *Vertically directed tongue pressures during swallowing decrease with the magnitude of an open bite* (Wallen, 1974).

- *Tongue and lip pressures **never** balance during a swallow*. Tongue pressures are always several times higher (i.e., there is no muscle balance).

- *Tongue and lip pressures during swallowing do not correlate well with tooth position*. Many tongue thrusters have normal occlusion.

- *The **duration** of tongue and lip pressures during swallowing do not balance out over time.*

- *Individuals who have undergone orthognathic surgery resume pre-op swallowing tongue pressures within one year following surgery*. Tongue pressures adapt to the environment in which they reside (Proffit et al studies, 1967-1978; see Pressure Transducer Studies in the Reference List).

Resting Posture of the Tongue

Perspectives revealed from research using oral pressure-transducers related to the *resting posture* of the tongue include:

- *In the horizontal plane, **resting** tongue and lip pressures do not balance out over time*. There is never any balance of tongue and lip muscles.

- *It only takes @ 15 gr/cm2 of continuous interdental resting pressure to inhibit the eruption of anterior teeth, while for posterior teeth; the figure is @ 35 gr/cm2* (Proffit, 1986).

- *When there is an anterior interdental rest posture of the tongue, for hours per day, dental eruption is disturbed and a process of differential dental eruption can be triggered* (Mason, 1988; Mason and Proffit, 1974; Proffit, 1986).

- *Differential dental eruption,* resulting from an interdental tongue tip at rest with the mandible hinged open, involves inhibiting anterior dental eruption while accelerating posterior eruption and vertical drift (Proffit, 1986). Differential dental eruption is not solely a process of teeth eruption. Posterior teeth over-erupt and the alveolar bone *follows along* by a process of *vertical*

drift. The result of vertical drift is that teeth do not erupt vertically out of their sockets; rather, teeth and alveolar bone drift together (Enlow and Hans, 1996). At the same time, anterior teeth cannot erupt due to the interdental rest position of the tongue (Proffit, 1986).

- *An anterior interdental rest posture of the tongue continuing for hours per day can lead to an anterior open bite or incisor flaring.* The ***duration*** *of pressure is a key*. Only light continuous postural or orthodontically applied forces are needed to move teeth (see References under Dental Equilibrium). Intermittent orthodontic pressures, such as force applications against a tooth or teeth with retainer springs, differ from the infrequent intermittent forces of tongue thrust swallows that have ***not*** been shown to result in the movement of teeth.

Why Then Do Teeth Remain in a Stable Position, Either in Normal Occlusion or Malocclusion?

The answer from dental science is explained in equilibrium theory. **Muscle balance or imbalance is not the same as dental equilibrium.**

Proffit (1978) explained that for the dentition to be maintained in a stable position, some sort of equilibrium would need to be involved to facilitate stability of the dental arches. Proffit and colleagues have identified a myriad of influences that account for dental equilibrium. These influences include: 1) intrinsic pressures – periodontal fibers and gingival fibers; 2) external pressures – habits, and orthodontics; 3) soft tissue pressures of the lips, cheek and tongue; and 4) tooth contacts – masticatory and swallowing.

The freeway space is one of several contributors to dental equilibrium. When the freeway space is disturbed or changed by an OMD, vertical and horizontal consequences to the dentition will be expected to follow.

Tooth position stability, or dental equilibrium, as well as the resting freeway space, involves a cortical control mechanism mediated by

the maxillary and mandibular branches of the trigeminal (V) cranial nerve tract to and from the trigeminal nucleus in the pons. A host of biochemical events surrounding the periodontal membrane space serve to monitor and also allow changes in tooth positions from long periods of continuous or intermittent orthodontic force applications against the dentition (see Davidovitch et al. under Dental Equilibrium in the References).

When a normal occlusion is disturbed by an airway issue or habit pattern, the dental equilibrium is disrupted. This can lead to an altered occlusion, or malocclusion that can remain stable in an altered state of equilibrium until the airway issue or habit pattern is addressed.

It is well-accepted in dental science that resting tongue pressures are important determinants of dental changes. A tongue thrust, when accompanying a forward interdental tongue rest posture, can potentially exacerbate a developing malocclusion, but tongue thrusting alone is not linked to dental change (Proffit, 1986).

What's New with OMDs, OMT, and the IAOM?

Orofacial myofunctional therapy procedures with OMDs can be effective, consistent, and successful, but only after any airway interferences or allergies have been resolved. As the discipline of orofacial myology continues to evolve, changes in terminology and perspectives will occur. Some selected changes are:

- Therapy has been recast as ***orofacial rest posture therapy*****.** This change in perspective recognizes the impact of oral posturing on dental changes, and the adaptive, opportunistic nature of tongue thrusting. We recommend that tongue thrusting should be corrected where there is an associated cosmetic problem or an accompanying interdental, tongue tip forward, rest posture.

- A lips-apart, mouth-open rest posture is **not** necessarily mouth breathing (Hanson and Mason, 2003).We advise orofacial myologists, physicians and dentists to exercise caution in

labeling a patient as being a *mouth breather* in the absence of verification by aerodynamic assessment.

- The *freeway space* is an important concept associated with OMDs. A primary goal of orofacial myologists is to recapture or establish a normal dental freeway space, or interocclusal dimension.

- Working to achieve *lip competence* is an important goal of OMT. In many instances, therapy to achieve a resting lip seal can obviate the need for tongue therapy and can also lead to a normal freeway space dimension.

- The current view in orofacial myology is that a tongue thrust and forward interdental resting posture of the tongue serve as *clues* that there may be a retained sucking habit or unresolved airway issue. Such patients need to be referred to allergists and ENT specialists for a definitive evaluation of the airway.

- We advise discontinuing the use of the inaccurate term *muscle imbalance*. Instead, we recommend a focus on lingual *resting* and *functional patterns*.

- In clinical reports, we recommend prefacing the term tongue thrust with an adjective wherever possible, such as *transitional, obligatory, adaptive, neuromotor*, (even) *cosmetic*.

- We recommend the elimination of the term *excessive pressure* as has been inaccurately applied to OMDs. Tongue thrusting,for example, does not involve excessive pressure applied against anterior teeth (Proffit, 1973).

- The term *pattern* is a recommended term to use to describe a tongue thrust. Many orthodontists respond negatively to the historical (and inaccurate) focus and overemphasis on thrusting rather than resting tongue posture.

What does the future hold for the field of orofacial myology?
Interest in the posterior airway and its influence on anterior oral postures and functions should continue as a focus of clinical research

interests. A possible role for the orofacial myologist in working with sleep-related problems has not yet been clearly identified.

The many opportunities and challenges ahead for the field of orofacial myology can be addressed successfully with improved communication and collaborations involving physicians and dentists who treat individuals with OMDs.

Summary

Orofacial myofunctional clinicians treat abnormal oral rest postures and muscle functions that can influence dental occlusion, chewing, and swallowing. The focus in therapy is on teeth-apart postures and behaviors. By contrast, dental specialists focus on teeth-together relationships. Orofacial myofunctional therapy is not speech therapy.

The tongue can act as a functional appliance by encouraging unwanted additional dental eruption and changing eruption patterns in the dentition. An interdental rest position of the tongue can lead to differential dental eruption and the creation of an anterior open bite malocclusion.

A tongue thrust is not a cause of malocclusion. Not all individuals who exhibit a tongue thrust have a speech problem and not all who have a speech problem have a tongue thrust.

Orofacial myologists should maintain collaborative interactions with referral resources in dentistry and medicine.

Reference Section:

The Reference section includes studies and texts cited in this document. Included as well are a list of recommended *classic studies* from dental science by Proffit and colleagues that documented oral functions related to OMDs. Selected reference texts are cited as resources that provide background information from dental science regarding OMDs, dental development, and orofacial growth and development.

For dental and medical professionals who may develop a specific interest in OMDs, the world-wide leading orthodontic text by Proffit, Sarver, and Fields (2013) is recommended as an excellent resource. The Hanson and Mason text (2003) is specific to OMDs., and continues as the world's best-seller on orofacial myofunctional disorders. This text was translated into Chinese (2021) and is now being published and sold in China.

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