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MYTHS THAT PERSIST ABOUT OROFACIAL MYOLOGY

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ABSTRACT

This article addresses many *myths* that have persisted over the years in dentistry and orofacial myology regarding the nature of orofacial myofunctional disorders (OMD's). Myths include 1) the concept that the term "tongue thrusting" includes the rest posture; 2) that there is an excessive amount of pressure exerted against the anterior teeth in swallows, that swallowing pressures add up, and the frequency of swallowing has an impact on the dentition; 3) the idea that the tongue is the strongest muscle in the body; 4) the view that a muscle will be the winner in any tug of war between muscle and bone; 5) the claim that a tongue thrust can cause an open bite malocclusion; 6) the claim that a tongue thrust can cause a Class II malocclusion; 7) the claim that the tongue molds the palatal vault; 8) the notion that a low tongue tip posture at rest presents a problem; and 9) the claim that OMD's represent a muscle imbalance that can be brought into balance with therapy. Each of these false claims or "myths" is discussed and corrected, with the positive acknowledgement that clinicians are abandoning the incorrect notion of muscle balance and imbalance as had been claimed previously.

INTRODUCTION

It is a natural process in the evolution of professional groups for various untruths, or myths, to develop. In most cases, such myths are attempts to explain a variety of phenomena for which there are no available supporting data. Such is the case within the developing professional discipline of orofacial myology.

The purpose of this article is to select untruths, or myths, that have been passed along over the years which are not valid concepts. Providing corrections for such myths helps to advance the discipline by clarifying claims made about orofacial myofunctional disorders (OMD's).

How Do Myths Originate? Orofacial myology is still a young discipline. A few orthodontists and dentists considered to be the early pioneers of the field were prone to making claims for which there was no research support. Many of these claims have persisted without challenge or clarification over the years. The unproven claims (or myths) discussed here, are found in the early self-published text on myofunctional therapy by Daniel Garliner (Editions 1, 2 and 3; 1971, 1974, 1983).

Since these myths continue to be stated and claimed by some orofacial myologists on websites, and are still held by some dentists and orthodontists, there is a need to further clarify and correct these myths. The field of orofacial myology will advance as accurate claims about the phenomena involved lead the way.

MYTH #1: The term "tongue thrust" includes the concept of the resting posture of the tongue.

It has become common for many to discuss the familiar term "tongue thrust" and to imply that the term encompasses the resting posture of the tongue. This is not an appropriate generic use of the term since "tongue thrust" denotes a functional activity of the tongue, as in swallowing or speaking, rather than referring in any way to the posture of the tongue at rest.

The distinctions between the resting posture and functional activities of the tongue are important. The link between the tongue and dental malocclusions is clearly related to a forward resting posture of the tongue. There is no proof, however, that tongue thrusting can cause malocclusions. A tongue thrust swallow is insufficient in *frequency*, *duration*, and *force application* to account for any dental changes. Those patients who tongue thrust and also have an anterior (or lateral) resting posture of the tongue, have a direct causal link with certain malocclusions such as anterior (or lateral) open bite (Proffit, 1978, 2000).

Discussions of tongue thrusting should not be linked with tooth positions and malocclusions except to describe tongue thrusting as an *opportunistic behavior* that finds and fills spaces available in the dentition. When discussing the relationship of the tongue to the development or maintenance of certain malocclusions, discussions should focus on an abnormal resting position (posture) of the tongue, for which there are much data available to support a relationship between posture and dental malocclusions (Proffit,1973,1978,1986, 2000).

Every patient who presents for evaluation of an orofacial myofunctional disorder should be evaluated by clinicians trained in orofacial myology, and well as dentists, for the presence or absence of both tongue thrust behavior and an abnormal, forward resting posture of the tongue. Not all patients with a tongue thrust pattern will need therapy, nor will a malocclusion be expected to develop from this behavior (Proffit, 1973, 1978, 1986, 2000).

Myth # 2: A tongue thrust swallow exerts from 1 to 6 or more pounds of pressure against the anterior teeth during each of the 2,000 swallows per day, and excessive swallow pressures add up.

Proffit's classic oral transducer studies (see separate reference list: Selected Pressure Transducer Studies by Proffit and Colleagues) involving a variety of oral pressure situations that include speech and swallowing, have clearly and eloquently debunked the previously-held *myth* (Garliner, 1971, 1974, 1983) that each swallow involves from 1.5 to 6 pounds of pressure against the anterior dentition. This claim is without any merit whatsoever. In truth, the magnitude of a force application by the tongue against the anterior dentition amounts to about 50 grams/cm^2 (or 1.77 ounces) whether or not the individual is a tongue thruster (Proffit, 1973, 1978, 1986). While such pressures can vary from person to person, they fail to rise to the level of pounds of pressure applied by the tongue against the teeth. Well-documented swallow pressures show pressures to fall well below a pound (or 454 grams) and in no way ever approach the 1.5 to 6 pounds of pressure claimed.

The myth that an individual swallows 2,000 times per day has been debunked in dental science since 1965. It is general knowledge in orthodontics that an individual swallows up to 1,000 times per day. The mean value established in 1965 was 585 (Lear, Flanagan & Moorrees, 1965); however, children tend to swallow more frequently, in the range of 800 to 1,200 swallows per 24 hour period (Lear, Flanagan & Moorrees, 1965). In current orthodontic texts, the 1,000 swallows per day figure is mentioned (Proffit, 1986, 2000).

A third part of these claims is that *swallow pressures add up*. Biochemical research involving the periodontium (Davidovich & colleagues, 1975, 1976) has revealed that ***swallow pressures (and other intermittent forces) do not add up or otherwise accumulate over time.*** Moving teeth in humans would require a minimum of approximately six hours per day of continuous pressure (Proffit, 2000, pg. 129). Even if the pressures during swallowing were 1.5 to 6 or more pounds as has been falsely claimed, this type of heavy intermittent pressure would have no impact on the long-term position of teeth. For these reasons, orthodontists are not interested in how many times a person swallows each day, or the amount of pressure involved in each swallow since the act of swallowing lacks the appropriate *duration* to initiate the cellular changes necessary to move a tooth or teeth.

MYTH # 3. The tongue is the strongest muscle in the body per square inch.

This myth is intended to further highlight the amount of excessive pressure that the tongue can exert against the dentition during thrusting. As mentioned above, the relationship between tongue pressure and the position of teeth is not based on factual data. It has been recommended by Mason (2009) that the term ***pressure*** (especially ***excess pressure)*** should be purged from discussions of OMD's and replaced by the concept of ***patterns*** *of activity*.

There are a variety of instruments that have been developed to measure tongue strength. Using these instruments, it is easy to demonstrate that the jaw approximating muscles are stronger than the tongue. Consider this example: although an adult can stand on an ice cube and not break it, an ice cube placed between the upper and lower posterior teeth can be crushed by the 400+ pounds of pressure per square inch that can be applied by the masseter muscles. In no way is the tongue a match for such a performance.

More importantly, however, is the recognition that the claim of the tongue being the strongest muscle in the body has no reasonable or positive impact on orofacial myofunctional therapy or the field of orofacial myology. Such a statement highlights instead a lack of understanding of the inaccurate notion that the amount of pressure generated by the tongue is an important variable associated with OMD's.

MYTH # 4. If there is a war between a muscle and a bone, the muscle will always be the victor.

This often-repeated claim is naïve and untrue. More importantly, it does not highlight the field of orofacial myology in the way intended. The implication of this claim is that the tongue can become out of control and exert excessive pressure against the teeth which then leads to a variety of ills, including the development of malocclusions. The unfortunate aspect of this implication is the untrue notion that the more pressure involved with a tongue thrust, the more damage will occur elsewhere, as with the dentition.

As previously mentioned, the amount of pressure generated by a tongue thrust habit pattern has no relationship to dental changes. The concept of excessive pressure should be purged from the vocabulary of the orofacial myologist since the amount of pressure is not a consideration when explaining dental changes related to the tongue. While the resting posture of the tongue has a cause and effect relationship with some dental changes, tongue thrusting and the amount of pressure involved in thrusting, is not related to the position of teeth, or the strength of the tongue (Proffit, 1976).

Another theoretical misconception involved here is the notion that one can separate out one muscle and pit it against one bone, and then observe what happens, anticipating that the result will be a victory of the muscle over bone. This does not happen in the real world. Pitting a specific muscle against a specific bone does not represent or replicate any situation in human anatomy and physiology. Instead, the philosophical perspective recommended for orofacial myologists is to appreciate the interconnections and *reciprocity* in anatomy and physiology that characterize oropharyngeal behaviors.

One of the most admirable capabilities of the tongue is its ability to adapt to the surrounding anatomy. The tongue easily adapts to changes in the configuration of the oral cavity with growth of the faucial tonsils, natural changes in the dentition, and enlargements of the pharyngeal tube. A central role of the tongue is to adapt to the demands of the respiratory system. When the tongue repositions itself or functions in a manner that is outside of the normal range, therapy to correct tongue posture and functions should be done with appreciation of, and respect for, airway demands and the limitations of the surrounding orofacial and oropharyngeal architecture. The tongue should be appreciated for its amazing ability to adapt its position and functions to airway needs and to the environment in which it lives, rather than envisioning it as a structure attempting to conquer adjacent anatomy.

MYTH # 5: A tongue thrust swallow can cause an anterior open bite malocclusion.

This myth has been adequately dispelled in other publications and documents (Proffit, 1973, 1978, 1986; Mason & Proffit, 1974; Hanson & Mason, 2003; Mason, 1988, 2004, 2009), yet many dentists and orthodontists, as well as some orofacial myologists, continue to endorse the *myth* that tongue thrusting is a cause of malocclusions. The presumed and inaccurate link of thrusting with an open bite malocclusion is especially difficult to understand, and is a false claim that needs to be dispelled.

A tongue thrust swallow represents a very brief, transient force application of the tongue against the anterior dentition. The amount of pressure exerted against the anterior dentition is well within the normal range. The periodontal membrane apparatus has the capacity to respond and rebound quickly from any brief force applications (Proffit, 1973, 1978, 1986). These facts should be sufficient to convince anyone that a tongue thrust behavior is not a cause of malocclusions. Nonetheless, the misconception continues among some.

The *myth* that tongue thrusting can move teeth is further debunked by the biochemical studies of Davidovich and colleagues (1975, 1976) who demonstrated that a requirement for a force application to move a tooth or teeth involves *continuous* pressure applications for hours per day before significant amounts of specific enzymes are built up, which are needed to activate the sequence of periodontal activities that result in movement of teeth.

The claim of a link between a tongue thrust swallow and an anterior open bite malocclusion is especially puzzling since it is difficult to understand or envision that a transient burst of energy from the tongue tip can result in either retrusion of anterior teeth or the excess eruption of posterior teeth that would be needed to develop an open bite malocclusion. By contrast, it is easier to envision the inaccurate view that ***tongue thrusting*** against the palatal surfaces of upper anterior teeth could cause these teeth to protrude, and yet this claim is also questionable and lacking in research support. If true, one would expect to find mobility of teeth, spacing at the upper incisors, alveolar bone loss and gingival tissue problems resulting from such trauma. Such findings have not been claimed or documented. However, as will be discussed below, a specific abnormal ***resting posture*** of the tongue can contribute to the development of a Class II malocclusion.

The relationship between the tongue and the development of an open bite malocclusion has been described in detail by Proffit (1974, 2000), Hanson and Mason (2003), and Mason (1988, 2009, 2010). The contribution of the tongue to an open bite malocclusion involves a forward, interdental ***resting posture*** between the anterior teeth, along with a mandible slightly hinged open so that the dental freeway space is also habitually open beyond the normal range for an extended period. A forward tongue posture, when assumed for hours per day, accompanied by an increase in the interocclusal (freeway) space, triggers *additional*, unwanted eruption of posterior teeth. At the same time, the interdental tongue resting posture *inhibits* concomitant anterior eruption. The result is an anterior open bite malocclusion, the product of ***differential dental eruption*** from increased posterior eruption and a lack of concomitant anterior eruption.

Of particular interest here are the findings from the dental eruption studies by Proffit and colleagues (summarized in his texts, 1986, 2000, 2007), estimating that only 15 grams of force are needed to impede the eruption of anterior teeth, while for posterior teeth, only 35 grams are needed. The concept of ***differential dental eruption,*** with the tongue tip postured interdentally to impede anterior eruption, and an excess opening of the posterior dentition for hours per day that encourages additional posterior dental eruption, provides a key explanation as to how a forward resting interdental posture of the tongue can be linked to the development of an open bite malocclusion.

MYTH # 6: A tongue thrust swallow can cause a Class II malocclusion to develop.

The same criticisms made of a cause-effect relationship between thrusting and an open bite also apply to the scenario that tongue thrusting can lead to the development of a Class II malocclusion. This is a myth promoted by some early orthodontists and is still believed by many in dentistry.

The evidence that the short duration of a tongue thrust swallow against the teeth and the impressive rebound capacity of the periodontium to adapt easily to transient bursts of pressure against the teeth dispels this myth (Proffit, 1973, 1978, 1986). Not so, however, with the rest posture of the tongue, since there appears to be a causal link with a developing Class II malocclusion.

Mason (1988, 2009, 2010) has explained how a specific rest posture of the tongue can account for the development of incisor protrusion and a Class II malocclusion. This posture involves the anterior and lateral margins of the tongue splaying over the biting surfaces of all lower teeth, with the mandible hinged open. Such a posture encourages additional eruption of all upper teeth while the lower teeth are inhibited from erupting by the tongue covering the occlusal surfaces of lower teeth. In essence, *the tongue can act as a* ***functional appliance*** in facilitating the development of a Class II malocclusion.

Several findings from dental science are especially useful here: Harvold (1974) and Woodside (1977) have described the curvilinear eruption pathway for teeth: maxillary posterior teeth follow a forward and downward eruption pathway whereas lower posterior teeth normally erupt upward, but not forward. As this eruption sequence occurs naturally, mandibular growth helps to maintain normal dental contacts between the upper and lower dental arches. When additional downward and forward maxillary dental eruption occurs in the absence of mandibular eruption because of the inhibiting presence of the lateral margins of the tongue, a Class II malocclusion can develop.

As mentioned above, only a small amount of sustained force is needed to inhibit eruption of teeth, with estimates of 15 grams to impede eruption of anterior teeth, and 35 grams for posterior teeth (Proffit, 1973, 1978, 2000). A change in the pattern of dental eruption, resulting from an abnormal resting posture of the tongue with splaying the tongue margins over the lower dentition, and accompanied by an open-mouth mandible position and an increased freeway space dimension for hours per day, can combine to account for the development of a Class II malocclusion. In this scenario, the tongue exhibits the features characteristic of a dental functional appliance.

An understanding and appreciation of the differences between tongue thrusting and an abnormal anterior resting posture of tongue should help clinicians generate appropriate goals for therapy based upon accepted dental science. To highlight the differences between thrusting and rest posture, the recommendation has been made of recasting orofacial myofunctional therapy as **orofacial rest posture therapy** (Franklin, 2009). This designation serves to properly identify and highlight the causal relationships between the tongue's resting posture and selected malocclusions, while also correcting a historical over-emphasis on tongue thrusting and the need for its correction as linked with the occlusion. The recent emphasis on the posture of the tongue *at rest* does not negate the need in some individuals to correct a tongue thrust pattern where it creates a cosmetic issue for a patient. Therapy for tongue thrusting, however, should not be prescribed for the false goal of correcting or diminishing a malocclusion.

MYTH # 7: The tongue molds the hard palate in orofacial growth and development, accounting for the configuration of the hard palate.

This common myth has seemed reasonable enough and has been accepted and passed along over many years. In truth, the tongue does not play a significant role in the growth and development of the hard palate and palatal vault. The tongue does not "mold" or otherwise affect the overall growth and development of the hard palate.

The discussion of this myth requires considerable detail since most orofacial myologists will not be familiar with this information. The mechanisms involved in the growth and development of the hard palate are complicated and inter-twined. The explanations for how the palate grows and assumes its shape requires a discussion of selected aspects of orofacial and pharyngeal growth and development. The classic studies and explanations by Enlow and Hans, (as described in the 1996 text ***Essentials of Facial Growth*** by Enlow and Hans, 1980), should be credited here as the information base for the descriptions to follow (with my sincere apologies to these authors for attempting to shorten and simplify their detailed and thorough expositions).

General Principles Of Growth Related To The Hard Palate: Growth of craniofacial structures is not an isolated process dependent upon a single event. In the case of the hard palate, its growth is not a product of molding by the adjacent tongue. The adult hard palate is not the same palate seen in infancy that has simply grown larger. The adult hard palate is not even composed of the same tissues as those present in infancy, nor does the adult palate occupy the same actual position.

Most of the factors influencing and controlling the growing hard palate are located outside of the palate, rather than from internal palatal components. These factors include developmental rotations, displacements at sutures far removed from the palate, and multiple remodeling movements that relocate it to new positions and continually adjust its size, shape and alignment throughout the growth period (Enlow & Hans, 1996).

Embryology: As described by Enlow and Hans (1996), during the fourth to sixth weeks of embryonic development, there are many regional changes in facial growth occurring simultaneously. The oral cavity is small and a sizable tongue is interposed between the pendant right and left palatal shelves which have descended vertically due to the position of the tongue. Following this, the vertical expansion of the face carries the tongue down with it. For the palatal shelves to move toward one another, the tongue descends faster that the enlarging palatal shelves, allowing the maxillary shelves to move medially and eventually fuse along the midline palatal raphe. The merger of the palatal shelves forms the secondary palate, a direct extension of the maxilla from which it is derived. The nasal septum also merges with the superior surface of the palate, closing off two nasal chambers from the oral cavity along the midline. The original primary palate, formed by the premaxillary segment, is retained as a triangular segment that joins the secondary palate just in front of the incisive canal. In all, for the hard palate to close successfully, the lower face (tongue and mandible) descend more rapidly than the maxilla and palatal shelves (Enlow & Hans, 1996). Rather than molding the palates, the role of the tongue is to get out of the way. When it does not, a cleft palate follows. (Note: This is only one of many reasons for cleft palate formation).

Growth And Development Of The Hard Palate: The master growth template for the face is the cranial floor (the *basicranium*, or anterior *endocranial fossae*). This means that the entire cranial floor, including the lateral parts where the condyles articulate, determines and directs facial growth and development downward and laterally from this base location, and determines the ultimate position of the palates; also accounting for their configuration. The many growth and development contributors to palatal shape and location include all planes of space. In the transverse plane, the interorbital distance, formed in conjunction with the constraints determined by the basicranium, contributes directly to maxillary arch form and the shape and dimensions of the hard palate (Enlow & Hans, 1996).

The course and spread of the olfactory nerves is another major factor in palatal location and the extent of maxillary protrusion. The course of the optic nerves relative to the cranial floor is an important factor in accounting for the rotation of the palate and the maxillary arch, and is also related to human upright stance (Enlow & Hans, 1996).

Growth Concepts: The configuration of the hard palatal vault is also related to the growth concept of **remodeling**. The reason why a bone must remodel during growth is because its regional parts must be moved. The sequential and progressive movement of component parts of a bone as it enlarges is termed **relocation**. The surface that faces toward the direction of movement is **depository** with regard to new bone laid down, while the opposite surface, facing away from the growth direction, is **resorptive**, with bone being removed.
Many facial bones, including the hard palate and mandible, have a V-shaped configuration. In such bones, deposition occurs on the inner side of the V (in the case of the hard palate, on the oral side) whereas resorption occurs on the outer (nasal) surface. The direction of movement with growth enlargement is toward the wide end of the V, thus, a simultaneous growth expansion and widening of the palatal shelves occurs.

For the palate to expand according to the V-principle, the growth expansion involves a process by which its size, shape and development is a response to the composite of all the functional soft tissue relationships associated with that individual bone. Its increase in size involves one or more articular contacts with other bones that are also enlarging at the same time. For these reasons, all articular contacts are important because they are the sites where displacement is involved. Articulations are the interface surfaces away from which the displacement movements proceed as each whole bone enlarges. The amount of enlargement equals the extent of displacement (Enlow & Hans, 1996).

Shaping The Palatal Vault: The tongue does not play a significant role in contributing to the shape of the palate. As is well known, most habit patterns are associated with some economical movement or activity that results in pleasure or convenience, and not requiring a full effort to maintain the habit. When the tongue is slightly protruded, the blade of the tongue can easily contact the posterior hard palate and the palatal vault. Rather than influencing the shape of the palatal vault, however, the open-mouth posture that accompanies a forward, interdental resting posture of the tongue also *lowers* the tongue blade and results in a loss of the tongue's role in resisting the normal forces of the muscles of the cheeks. The consequence of this forward tongue resting posture, with the tongue blade positioned low and away from the posterior maxillary teeth, is that the posterior maxillary dental arch can be narrowed by unopposed pressures of the cheek muscles. An open mouth posture with a low position of the tongue blade may also result in excess vertical eruption downward of maxillary posterior teeth, and accompanying vertical drift of supporting alveolar bone.

In summary, the general explanation for how the palate develops, including the shape of the hard palatal vault, involves *regional growth* starting at the basicranium (cranial floor), the overall template from which the palate develops. As part of the growth and development process involving the vault of the hard palate, the tongue lowers. The shape of the palate is influenced, through regional growth, by anatomical characteristics and dimensions *above the palate*, including such factors as the route of the optic nerves (a large factor in the rotation of the palate and maxillary dental arch); the interorbital distance (which influences the width dimensions and the shape of the palate); the course and spread of the olfactory nerves (a major factor in palatal location and extent of maxillary protrusion); the buccal and labial musculature (which are obvious biomechanical influencing factors); and whether the facial skeleton and dentition is Class I, II, or III, since each has a differential effect on palatal growth and form. In all, palatal development, shape and form progresses from the basicranium downward, with the tongue and mandible lowering to get out of the way during the various growth and development actions above the hard palate that influence its shape and position, as well as influencing the width of the upper dental arch (Enlow & Hans, 1996).

The Functional Matrix: The *regional growth* explanation for palatal growth and configuration is compatible with the *form/function principles* originally proposed by van der Klaauw in 1952 and later expanded and elaborated by Melvin Moss (1969). All of Moss's extensive "Functional Matrix" components are involved in explanations of the regional growth of the hard palate.

The *functional matrix* concept was developed primarily to explain bone growth; however, the biologic principles involved can also be applied to soft tissues (Enlow & Hans, 1980, pg. 206). Rather than intending to explain **how** the actual morphogenic process works, the *functional matrix* concept describes **what happens** in the process of facilitating the combination of actions, reactions, and feedback that interplay in osteogenic regulation (Enlow & Hans 1980, pg. 206). The growth of each bone is a composite of multiple developmental regulatory conditions that continuously adapt a bone and account for a its ongoing configuration, size, fitting, and the individual growth timing involved (Enlow & Hans, 1980, pg. 206).

The term "functional matrix" can be misleading because it suggests an emphasis on the influences and actions of soft tissue parts, such as muscle contractions. However, the growth enlargements of bone are also directly involved in providing the signals that activate osteogenic connective tissues.

The Relationship Between Facial Form And The Palatal Vault: The vertically longer nature of the dolichocephalic midface results in a higher vaulted hard palate and narrower and deeper maxillary dental arch. The broader and shorter brachy-cephalic midface leads to a wider and shorter palatal vault and maxillary dental arch. Thus, the configuration of the hard palate is a projection of the anterior cranial fossa and the configuration of the maxillary dental arch is established by the perimeter of the hard palate (Enlow & Hans, 1996).

The Relationship Between Class II And III Skeletal Features And The Palatal Vault: In individuals Class II malocclusions, the anterior cranial fossa is relatively long and narrow, and the headform type is often dolichocephalic (narrow and long), with the hard palate and maxillary arch being correspondingly narrow and elongated. Since the middle cranial fossa in individuals with Class II malocclusions is inclined forward and downward, the entire nasomaxillary complex is placed more protrusively, causing a downward and backward growth rotation of the mandible.

In individuals with Class III malocclusions, both the anterior and middle cranial fossae tend to be brachycephalic (wider and shorter), with a correspondingly shorter but wider hard palate, maxillary arch and pharynx. The nasomaxillary complex is placed more retrusively in individuals with Class III malocclusions. Although the faces of some individuals with Class III malocclusions may appear to look longer, it is the lower face (mandible) that causes this appearance (Enlow & Hans, 1996).

The combination of multiple features described above for the nasomaxillary complex account for the composite skeletal characteristic of mandibular retrusion and narrower palatal vaults and maxillary arches in individuals with Class II malocclusions, and mandibular protrusion and wider maxillary arches with flatter palatal vaults in individuals with Class III malocclusions. The general features described here occur in about 70% or more of individuals with Class II and III malocclusions (Enlow & Hans, 1996, pg. 190).

Do Sucking Habits Influence The Configuration Of The Palatal Vault? Although the myth discussed here focuses primarily on the inaccurate concept that the tongue molds the palatal vault, some discussion is merited regarding the role of sucking habits in modifying the shape of the palatal vault and narrowing the maxillary arch width. It is true that the forces and factors involved in ordinary palatal and maxillary arch growth can be temporarily overridden by extrinsic forces such as finger and thumb sucking. As is widely believed, it can be easy to determine which thumb or fingers are involved in a sucking habit by observing the contour of the hard palatal vault.

The dental consequences of a sucking habit may include the development of a maxillary posterior crossbite; posterior vertical elongation of the maxillary arch with vertical, downward drift of alveolar bone; maxillary incisor protrusion, and/or an anterior open bite. If the maxillary dental arch elongates vertically, this exaggeration increases the perception of narrowing of the palate.

Although the presence of a thumb or fingers in the oral cavity for hours per day can distort the palate, such habits do not appear to be responsible for the long-term development or shape of the hard palate. After the habit is removed, the posterior crossbite and excess vertical lengthening of the posterior segments usually self-correct, often in a short period of time (Enlow & Hans, 1996).

Clinical Implications: There is a difference in the effect of a sucking habit and a tongue habit in influencing the shape of the hard palate. The **tongue** is not regarded as an important factor in the growth, development and configuration of the hard palatal vault. The tongue gets out of the way as palatal development occurs to fulfill its role of maintaining the airway space. In short, the tongue does not "mold" the palate, as previously thought.

By contrast, a thumb or finger **sucking habit**, with sustained negative pressures, and accompanied by an increase in the freeway space dimension and a loss of restraining lateral tongue pressure against the muscles of the cheeks, can lead to narrowing of the maxillary dental arch and can also cause some reshaping of the palatal vault. When such influences are removed, physiologic rebound occurs and subsequent development returns the component parts to a stable relationship (Enlow & Hans, 1996, pg. 164).

Clinicians should always separate the relationships and clinical observations of the height of the hard palatal vault and the width of the maxillary arch in light of the client's growth and development characteristics. For example, a normally shaped palatal vault can be found with a narrow maxillary arch.

The width of the maxillary dental arch involves a relationship between the muscles of the cheeks and the restraining pressures of the lateral margins of the tongue blade. In the case of a ***sucking*** **habit**, with the cheek muscles actively involved in creating a negative intraoral pressure (suction), both the hard palatal vault and the width of the maxillary arch may be narrowed; while by contrast, a forward resting, interdental posture of the ***tongue***, with the mandible open and the posterior tongue habitually lowered, allows the cheek muscles to narrow the maxillary dental arch into a crossbite relationship without influencing the palatal vault or the mandibular posterior dentition.

In summary, the tongue does not mold the hard palate in the developmental process of palatal growth and development although the lateral margins of the tongue are involved in maintaining stability of the posterior dentition. For thumb and finger sucking habits, it is important to follow the clinical guideline to remove the habit by the time that the adult incisors are ready to erupt in order to facilitate the physiologic rebound that will most likely follow from habit cessation. However, rebound can also occur spontaneously when a sucking habit is stopped that has persisted long after the adult incisors have erupted.

MYTH # 8: A tongue tip down resting posture at or behind the lower incisors is always undesirable and will cause dental problems and malocclusions.

Background And Reason For The Myth: The clinical practice of observing the position of the tongue tip has led to the false statement and conclusion on many IAOM member websites that a tongue tip down rest position will require therapy. ***This is not necessarily so!***

Clinicians tend to observe the position of the anterior tongue and may often neglect to identify and record the position of the tongue blade and the dental freeway space. It is important to recognize that the resting posture of the *blade* of the tongue does not always mirror the resting posture of the tongue-*tip.* ***Evaluating the position of the tongue blade is a critical observation in determining the need for orofacial myofunctional therapy.***

The tongue has been conveniently been divided into three parts: tongue tip, blade, and posterior tongue. Of special relevance to orofacial myologists is the often-independent posture of the tongue tip and blade. This will be the focus of discussion here in attempting to clarify the clinical implications involving the tongue tip and blade. A secondary consideration in this discussion is the resting freeway space dimension, or interocclusal space, as related to and influenced by the position of the lower jaw at rest.

Clinical Perspectives: If the lateral aspect of the ***blade*** of the tongue **at rest** contacts the lingual surface of upper posterior teeth, the restraining effect of the tongue against the cheek muscles (a.k.a. buccinator complex of muscles) will ***not*** allow the cheek muscles to overpower the teeth and cause a posterior crossbite. If the ***blade*** of the tongue is positioned at rest low and ***below*** the maxillary posterior teeth, a posterior crossbite may likely develop due to activation of the buccinator complex against the maxillary posterior teeth where there is a lack of normal opposing restraint from the tongue.

For discussion purposes, several scenarios will be presented: In each scenario, tongue posture will be described for both the ***tongue tip*** and ***blade***; 1) Discussion of the ***freeway space dimension***, will be included with the reference being the ***normal*** freeway space, characterized by anterior teeth separated by 4-5 mm at the incisors and posterior teeth separated 3 mm at the first molars. An ***excess opening*** of the freeway space indicates that the mandible is hinged open with the vertical (inter-incisal) spacing increased beyond 4-5 mm; 2) The ***tongue blade*** at ***normal rest*** denotes a light contact of the blade margins against the lingual surfaces of posterior teeth; 3) The tongue blade positioned ***low*** and not contacting any maxillary posterior teeth, denotes that the blade is resting between the mandibular posterior teeth only, and 4) the ***tongue tip resting either up or down***. The combination and expected consequences of these observations will be detailed below.

Scenario # 1. **Tongue tip up at rest - (at the spot), a normal freeway space, and the lateral margins of the blade of the tongue positioned high enough to provide normal resistance to the forces of the cheek muscles.** No malocclusion should result. No treatment is indicated.

Scenario # 2. **Tongue tip up at rest - and a freeway space dimension opened beyond the normal range:** The blade of the tongue in this scenario can be positioned low enough to lose the normal restraining relationship with the maxillary posterior dentition. When this occurs, a unilateral or bilateral crossbite may develop. Whether a crossbite is unilateral or bilateral can depend on whether one side of the posterior tongue rests higher than the other. The side with the lower tongue rest posture will likely encourage a unilateral crossbite to develop. A reminder: normal speaking individuals speak and swallow asymmetrically – one side rises higher than the other in function, and can also do so at rest with an excess opening of the freeway space.

Scenario # 3. **Tongue tip down at rest - behind/at the lower incisors and a normal freeway space, with lip competence, and normal elevation of the tongue blade:** If the blade of the tongue is positioned high enough to provide normal resistance to the forces of the cheek muscles, no malocclusion should result, either posteriorly, or at the lower incisors ***if lip competence has been achieved***. No treatment is indicated.

Scenario # 4. **Tongue tip down at rest - behind/at the lower incisors and a normal freeway space, with lip incompetence:** There should be no posterior maxillary crossbite and no changes seen in the lower anterior dentition caused by a tongue tip down resting posture with lip incompetence. Clinicians are reminded that lip competence is a normal, expected finding in children up to ages 12-13 years (Vig and Cohen, 1979). No myofunctional intervention is indicated where there is a normal interocclusal dimension, a low tongue tip resting position and lip incompetence.

Scenario # 5. **Tongue tip down at rest - behind/at the lower incisors and a freeway space opened beyond the normal range:** In this scenario, the lateral margins of the blade of the tongue at rest will most likely be positioned low enough to lose the normal restraining relationship with the maxillary posterior dentition. The buccinator complex of cheek muscles then become more activate ***when the mandible is hinged open***. A unilateral or posterior maxillary crossbite can develop over time. This scenario indicates the need for orofacial myofunctional therapy.

In summary, there are several clinical observations involved in determining whether the ***position of the tongue blade*** may lead to the development of a malocclusion. These include: 1) whether the tongue tip rests up or down; 2) whether the rest position of the blade of the tongue ***does or does not automatically follow*** from the rest position of the tongue-tip; and 3) whether the ***mandible is hinged open*** (this determines the vertical dimension of jaw opening, or freeway space).

If the tongue-tip rest position is low (behind or at the lower incisors) and the tongue blade rests against the lingual surfaces of maxillary posterior teeth, you can assume that the interocclusal (freeway space) dimension is normal. No crossbite should develop. This is a normal rest position for many children and adults (Takahaski et al, 2009; Schmidt et al, 2009).

Clinical Applications: 1) A **tongue tip up rest position** at the "spot" (over the incisive foramen area) is ***reaffirmed*** as the recommended resting position of the anterior tongue for most, but not all, individuals. This position serves to encourage the stabilization of a normal freeway space; a major goal of orofacial rest posture therapy. There is certainly merit in recommending an elevated tongue tip resting position in orofacial myofunctional therapy.

2) In patients with a tongue tip up rest position and a low position of the blade of the tongue, a recommended therapy technique is to encourage the mid-portion of the tongue to contact the hard palate as a way of elevating the blade of the tongue and thus, establishing or reestablishing a normal resting relationship between the lateral margins of the tongue and the lingual surfaces of maxillary posterior teeth.

3) For patients with a tongue tip down rest posture, with the mandible hinged open and the freeway space opened beyond the normal rest position, therapy to close down the mandible and elevate the tongue tip and blade is needed. One of many therapy techniques involves an exaggerated, closed position of teeth (in occlusion) that should be helpful in the process of re-establishing normal vertical dimensions of jaws and teeth, and to retrain the tongue to assume a rest posture at the anterior hard palate. Once the closed position has achieved the result intended, then working to find and stabilize a normal freeway space should follow.

4) For patients with a tongue tip down rest posture where the blade is elevated sufficiently to provide support for the position of the posterior dentition, no therapy is indicated simply because the tongue tip rests low in the mouth. At the discretion of the clinician, a further consideration of whether such a position is acceptable or not may depend on the presence or absence of lip competence.

5) For patients with **TMJ pain**, a tongue-tip up rest position is ***contraindicated*** since this is not a true physiological rest position. EMG studies show that a tongue-tip down resting posture should be taught for such patients since EMG activity of the muscles of mastication, and other muscles, show a marked decrease in resting tongue activity considered to be an optimal physiological resting position for the tongue (Takahashi et al, 2005; Schmidt et al, 2009).

Conclusion: The claim about a low anterior tongue posture as always indicating a problem is incorrect and is a myth, as detailed and qualified above. However, the clinical observation of a low anterior tongue posture should serve as a clinical reminder to evaluate the posture of the *tongue blade* and *freeway space*.

MYTH # 9: Orofacial myofunctional therapy involves muscle imbalances that can be changed to muscle balances.

Historically, many orthodontists and most orofacial myologists have envisioned the teeth in the middle of a dynamic muscle force field, with the tongue on one side of the dentition, and the opposing and "balancing" muscles of the lips, cheeks, and the muscles of mastication on the other side. This false view of the tongue and lips being in a muscular tug of war in the *horizontal plane of space* where an OMD is present presumes incorrectly that the prize from this perceived competition is control of dental position.

A two-dimensional perspective about the position of teeth, and their stability, fails to recognize the three-dimensional components that combine to explain *equilibrium theory,* and the specific contributions of the various components to the position and stability of the dentition. The components involved with dental equilibrium have been elucidated by Proffit (1978, 1986), and include tooth contacts, soft tissue pressures of lips, cheeks and tongue, external pressures, and intrinsic pressures associated with the periodontium. In addition, the role of the dental freeway space has more recently been recognized as a source of control involved with dental eruption and the stability of the dentition (Mason, 2009).

It is encouraging to note that current websites devoted to orofacial myology do not include the label of muscle imbalance or the claim of creating muscle balance with therapy. Most clinicians have now accepted the research from dental science demonstrating that there is never any muscle balance between the tongue and opposing muscles (Proffit, 1973, 1978, 1986, 2000). Therapy involving muscles is now directed toward establishing appropriate resting postures and eliminating noxious functional habit patterns. The unproductive and incorrect concept of *excessive pressure* previously linked with oral habits is being replaced by an emphasis on establishing appropriate *orofacial rest postures* and functional *patterns*. Orofacial myologists deserve congratulations for moving on from the inaccurate historical perspective of muscle imbalance to the recognition of the primary importance of resting postures as related to dentition.

CONCLUSION

The myths discussed and debunked above should help orofacial myologists clarify any confusing claims they may have been exposed to regarding OMD's, and to generate treatment plans based upon accurate information and perspectives that clearly distinguish between thrusting and the resting posture of the tongue in relationship to the developing dentition. Unfortunately, the conceptual and clinical misinformation discussed here has had a negative impact on the reputation of the field of orofacial myology among some clinicians in the dental sciences. Correcting and clarifying myths should help the field of orofacial myology to gain greater acceptance and enhance its reputation, as statements and claims about OMD's align with other fields whose professionals interact with orofacial myologists.

The important focus on the resting posture of the tongue as the primary link with the development of selected malocclusions is stressed, correcting the unproven notion that tongue thrusting is a cause of dental misalignment. While progress is noted in the accuracy of claims made about OMD's, clinicians practicing orofacial myology need to remain diligent when describing the field and their work in a manner that is compatible with well-documented research and perspectives from dental science.

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