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LOMA LINDA UNIVERSITY

Graduate School

TONGUE-THRUST ETIOLOGY: A REVIEW OF THE LITERATURE

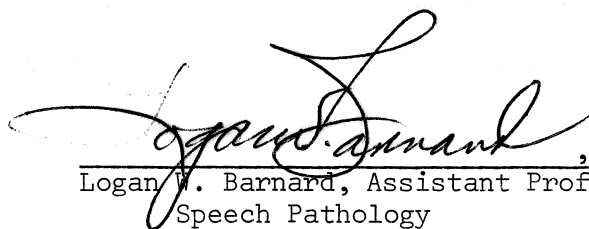
by


Betty C. Vine

A Research Study in Partial Fulfillment
of the Requirements for the Degree Master of Science
in the Field of Communication Disorders

June 1974

Each person whose signature appears below certifies that this research study in his opinion is adequate, in scope and quality, as a research study for the degree Master of Science.


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Chapter 1

INTRODUCTION

In recent years the attention of specialty groups has been drawn toward the peculiar oral behavior commonly referred to as tongue-thrust. This behavior is not only characterized by multiple symptomatology, but it also has been characterized by multiple terminology. Each specialty group attaches its descriptive label to it resulting in a variety of terms: infantile swallowing, reverse swallowing, perverted swallowing, deviant swallowing, visceral swallowing, teeth-apart swallowing, and orofacial musculature imbalance. These terms are all used synonymously in the literature.

Search of the literature indicates that this behavior has many components, is only partially understood, and is related to a number of disciplines such as anatomists, physiologists, neurologists, orthodontists, prosthodontists, periodontists, laryngologists, otologists, psychologists and speech pathologists. All have engaged in research affecting their own particular discipline but little advancement has been made due to the complexity of the behavior which demands interdisciplinary cooperation in order to reach some valid conclusions. Also much speculation has been made regarding who should be responsible for treating this anomaly.

Definition of Tongue-thrust

Respiration and swallowing, both essential to our very existence

are carried on via a common passageway, the pharynx. Both the body and root of the tongue which have important functions in swallowing must avoid the restriction of this airway. During deglutition the contents of the oral cavity are forced back into the pharynx and down into the esophagus by way of the pharyngo-esophageal sphincter which opens to permit the bolus into the esophagus where peristaltic waves carry it to the stomach. Closure of this sphincter occurs by a burst of neural impulses, and by action potentials in the cricopharyngeal muscle fibers.

The term "orofacial musculature imbalance" is used synonymously with "tongue-thrust". The three muscles concerned in this swallowing act appear to be the masseter and temporalis (of the masticatory group) and mentalis (of the facial expression group). The speech differences characterized by tongue-thrusters has been discussed by Fletcher et al (1961) who reported that no palpable contraction of the masseter muscles was observed during deglutition and that interference with swallowing was found when the lip contraction was prevented.

In order to understand the tongue-thrust swallow fully it is important to differentiate between the normal and abnormal swallow. During the normal swallow the tongue exerts little or no pressure on the upper incisors. Garliner (1971) describes the normal swallowing pattern as follows:

The tip of the tongue presses against the rugae behind the upper anterior teeth. The mid point of the tongue rises to meet the hard palate, with the posterior part of the tongue tipped at a forty-five degree angle against the pharyngeal wall. The teeth are closed and the lips are sealed. The swallow is accomplished with a negative intraoral pressure.

The abnormal or the deviant swallow presents a different

picture, one of which is also described by Garliner (1959):

The tip or sides of the tongue press either against or through the teeth anteriorly or laterally. The midpoint of the tongue is collapsed, the anterior part of the tongue is elevated, and the bolus or saliva is forced into the digestive tract with a positive rather than a negative pressure.

It has also been characterized in the following way: during the mylohyoid stage of swallowing the posterior teeth are not brought together. The orbicularis oris and other circumoral muscles exhibit asphincteric or peristaltic forms of behavior. The tongue thrusts forward spreading out between the anterior incisors.

Conversely somatic swallowing, or the mature pattern, is a more highly selective activity of orofacial muscles. The contraction of the masseter and the temporalis muscles brings the posterior teeth firmly together while the lips and cheeks remain in a relatively passive state and the tongue remains within the oral cavity.

Palmer (1962) suggests that observation of the tongue movements in the tongue-thrust swallow include an insufficient elevation of the tongue. The tip and the anterior third of the tongue are said not to approach the palate during any part of deglutition. Instead the necessary deglutition action is often described as a kind of sucking movement made possible by a tight oral closure and seal.

Another deviant swallowing difference which has been noted is that of minimal laryngeal excursion during the swallow which suggests that the laryngeal elevators and retractors may not function as effectively as or as completely as do the same muscle groups in non tongue-thrusters (Palmer 1962).

According to Staub (1960) a person swallows approximately twice a minute during waking hours and once a minute or less during sleeping hours. Pressure from this intermittent swallow builds up a pattern of 6,000 to 12,000 pounds force exerted somewhere in the mouth over a twenty-four hour period (Staub, 1960). One can readily see how problems can result if this pressure is exerted against the dentition rather than against the hard palate. It is thought that these pressures are great enough and frequent enough to account for the abnormal oral structures thought to be related to tongue-thrust.

Problems resulting from Tongue-thrust

For a number of years tongue-thrust and deviant swallowing have been described and discussed in speech, medical and dental journals and have been a controversial topic at speech and dental meetings. It is a condition that should be considered seriously because of its incidence in the general population primarily among school-aged children, especially in the lower grades. The results of tongue-thrust are manifested in various abnormal activities both facial and structural. One of the major problems resulting from tongue-thrust is malocclusion and sibilant tongue tip distortions. This condition is also characterized by a narrowed maxillary arch (resulting in crossbites), protruding anterior teeth (usually with spacing), an anterior open bite, and an abnormal swallowing habit (McWilliams and Kent, 1973). Staub (1960) also agrees that the tongue-thrust swallow usually produces an open bite. In addition to the deviant swallowing pattern itself there are other aspects of orofacial function which have been attributed to the

tongue-thrusting problem. An extremely tight occlusion of the lips during deglutition has been noted and has become an outstanding criterion of the tongue-thrusting behavior. The lip contraction appears at some times to extend into a facial grimace, with neatly outlined tracks in the facial tissues (Palmer, 1962).

Effect of Tongue-thrust on Speech

During the past few years there has been a controversy whether speech clinicians should provide therapy for children with tongue-thrust. In some public school systems the term "tongue-thrust" is abandoned for the term "orofacial muscular imbalance" as this behavior with its label of "tongue-thrust" is not considered to be within the speech clinician's domain. Whether the speech clinician should be concerned with the tongue-thrust of a child who does not have a speech problem is a debatable issue. However, the fact remains that clinicians throughout the United States are providing for it. Increasing numbers of children with tongue-thrust who also have defective speech should motivate the speech clinician to give serious consideration to the problem. Some contend that presence of tongue-thrust makes correction of a defective sibilant difficult and therapy for a speech defect is facilitated considerably by the stability of a proper swallow.

Specialists in other disciplines are acknowledging the fact that the speech specialist is recognized as the person most likely to have had training and experience in altering the habit patterns related to the use of the orofacial structures and increasing numbers of children are being referred to him for correction of the improper muscle

habits associated with tongue-thrust swallow, whether or not associated speech impairments exist. Some orthodontists prefer to have the child receive therapy concurrently with orthodontic therapy, but in most cases the patient is referred to the speech clinician prior to orthodontic treatment.

Chapter 2

STATEMENT OF THE PROBLEM

In addition to the wide variety of views and theories on symptomatology, speculations and hypotheses of what tongue-thrust may be and its manifestations, there is an ever greater discrepancy of opinion concerning the causal factors of this behavior.

What is its etiology? Is it organically based? Is it functional or a combination of the two? Is it developmentally or genetically bestowed? Is habit responsible with the perseveration of thumb- tongue- and lip-sucking or nail biting? Several writers feel that all infants are born with tongue protrusion; others suggest that improper feeding habits or other harmful influences are responsible. Some persist that tongue-thrust is a phenomenon of childhood resulting from neuromuscular deviancy, or an arrest at the oral stage of psychological development.

Upper respiratory conditions have been attributed to the etiology of this behavior as have faulty tonsillectomies or childhood diseases. Failure of maturation of tongue pattern, premature loss of teeth and other theories have also been submitted as a cause of the tongue-thrust anomaly.

Much controversy and numerous hypotheses concerning causal factors related to tongue-thrust have been propounded. Researchers have not discovered any conclusive etiological factors but they have postulated a number of perceptive theories, hypotheses, and opinions. It is

the object of this research paper to attempt to organize the most prevalent body of clinical investigation or hypotheses which have been submitted for publication in the literature or delivered at speech or dental conferences on the controversial subject of tongue-thrust etiology. It will coordinate points of agreement or disagreement between leading writers in the field.

This paper will be limited to the etiological theories of tongue-thrust as presented by writers and analysts who have made a significant contribution to the field. It will not include any remedial techniques or symptomatology.

The term "tongue-thrust" is a descriptive rather than an etiologic term and in order to simplify the complexity of terminology for this behavior, it will henceforth be referred to throughout this paper as the "tongue-thrust" swallow.

In recent years progressive technical developments have made it possible to evaluate lingual pressure (Proffit, 1972) and observation of the tongue-thrusting pattern by cinefluorographic analysis (Massengill et al., 1972), cineradiographic studies and cephalometric tracings (Speidel and Isaacson, 1971 and Sloan et al., 1951). These observations have proved valuable in the detection and measurement of tongue-thrusting.

If all etiological possibilities are considered within the framework of orthodontics or speech pathology, seldom will there be one single etiological factor. A complexity of causal factors has been projected. It has been felt that tongue-thrust may merely be symptomatic of some other primary problem.

Two schools of thought are prevalent in the existing controversy over the cause of tongue-thrust (McWilliams and Kent, 1973). One supports the tenet that form will change if function is changed. The other says that form must be changed in order to change function. Each agrees that form and function are related. Changing form would be limited to the field of orthodontics. Changing function would fall under the discipline of the speech pathologist. However, other leading researchers disagree and propose that change in function will not necessarily result in change in form (Subtelny, 1970).

There are four types of tongue-thrusts which have been identified (Goldberger, 1973). In the first the person thrusts his tongue against the anterior teeth; in the second, the patient pushes his tongue against the anterior region and the posterior region of the oral cavity; in the third, the tongue is thrust unilaterally or bilaterally; and in the fourth type the patient may open his mouth as much as an inch to thrust his tongue forward between his teeth when swallowing. All four types of tongue-thrusting are said to affect the formation of the teeth.

Tongue-thrust is an activity of opposing muscular forces of the mid and lower face, oral cavity and neck, that is associated with a number of abnormalities. However, it is basically agreed that this swallow pattern includes the following clinical characteristics (Fletcher et al., 1961): (1) extreme tension in the mouth closing musculature, (2) diminution or absence of palpable contraction in the muscles of mastication during the swallowing act, and (3) forward thrust of the tongue causing it to protrude between the incisors.

One of the most powerful, flexible and important organs of the human body is the tongue. It is also a major contributor to orofacial anomalies. Deglutition is the most constant activity of the tongue (approximately 3,000 times per 24 hour day) and because of the major part it plays in this activity and communication, it has been thought of as perhaps the primary cause of tongue-thrust (Weiss, 1969).

Many muscles in the tongue, palate and pharynx are associated with the larynx and hyoid bone. All are involved in the swallowing act. They do not act independently or in a random manner but they are coordinated sequentially into a patterned performance (Doty, 1951). The neural control of this highly coordinated muscular activity appears to be centered beneath the temporal lobe near the amygdoloid nucleus since stimulation here has elicited the linked performances of chewing and swallowing (Bosma, 1957). However, even though swallowing may be initiated voluntarily at high levels, most normal, unsolicited swallowing is believed to be controlled within the brain stem and to occur below the level of consciousness (Best and Taylor, 1950).

In summary then tongue-thrust etiology has been a highly controversial subject. It has been perceived as either organic or non-organic and therapy has been approached from either the hereditary or environmental point of view. It has been regarded as possibly having multiple causes with a number of precipitating factors. Tongue-thrust etiology therefore must be investigated with regard to the organic and functional activities of the human organism. Various opinions, assumptions, hypotheses, theories, and validated materials have been submitted in current literature. However, in order to conclusively find a solution for the

treatment of the tongue-thrust behavior, etiology must be more adequately understood so that therapeutic techniques might be more successfully developed.

Chapter 3

REVIEW OF THE LITERATURE

To place the existing material into simple categories is not easy because of the intricate involvements and manifestations of the tongue-thrust behavior. However, most of the theories mentioned in the literature which find some agreement of acceptance or appear to be taken as common knowledge seem to fall into two categories: (1) organic and (2) functional.

The organic theories would be categorized under the headings of: (a) hereditary-genetic, (b) structural deviancy, (c) tonsillar tissue, (d) innate at birth, and (e) maturational problems.

The functional theories would be categorized under the headings of: (a) upper respiratory infections and allergies, (b) surgical defects, (c) gap-filling or interference habits, (d) nursing and feeding habits, (e) non-nutritive habits, (f) oral fixation, and (g) neurological impairment.

ORGANIC THEORIES

Hereditary theory

One etiological hypothesis which has been advanced is heredity (Weiss, 1969). This theory propounds the thesis that tongue-thrust has been genetically transmitted from the parent to the offspring, and according to some writers an overwhelming number of concerned parents

of children with tongue-thrust have also shown similar dental structures and similar patterns of swallowing. Palmer (1972) has noted a similarity between the structural differences of the tongue-thrusting child and his parent, such as palatal and dental differences, as well as functional differences such as involving sibilant sounds. These observations provide a reason to be aware of possible heredity factors in tongue-thrust behavior. Wells (1968) also supported the role of heredity in determining a particular type of maxillary or mandibular growth that is conducive to open bites and tongue-thrusts. In addition Subtelny (1965) proposes that genetic factors must be considered since they predetermine to a degree the form and size of the child and dental tissues and have an influence on the position and path of teeth eruption. Ballard (1959) upholds this view and states that some children inherit a musculature which dictates from birth the classic development of retracted mandible, upper incisors in labioversion, everted lips, with a protrusive tongue resting interdentally in order to form a labioglossal anterior seal in swallowing. According to Cauhepe (1955, cited in Fletcher) he mentioned another factor as predisposing for tongue-thrust as an inherited orbicularis oris hypertony resulting from specific anatomical configuration and neuromuscular interplay and generating a tongue-thrust pattern of motion. Gwynne-Evans (1952) also looked upon the subject from the genetic point of view, stressing the familial patterns of behavior. In a study by Tulley (1969) he found a familial pattern of tongue-thrust behavior in thirty percent of the group tested and states that tongue-thrusting is particularly marked in sibilant sounds of speech and may often be seen in siblings and in one of the

parents.

Structural Deviancy Theory

According to Hoffman and Hoffman (1965) tongue-thrusting may be a temporary developmental manifestation occurring throughout or intermittently during growth and development of the lower face of some individuals. It may also persist as a habit after growth and development are complete or as a necessary positioning of the tongue if growth and development are inadequate when completed.

Scott (1961) advanced the theory that bone supporting teeth must be able to withstand normal pressures exerted during swallowing, speech, and mastication. According to this theory abnormal muscle action can produce bone deformity. Ricketts (1965) has indicated that final tooth positions and dental arch forms are determined not by development of the teeth but by the soft tissue environment. He states further that certain dental abnormalities may well be the result of improper tongue position and function. Harvold (1968) appears to agree with Ricketts, as he maintains that the tongue and facial muscles are the factors which determine the size of the dental arches and the crowding or spacing of the teeth.

In 1967 Sloan and colleagues reported a study to establish possible differences in hyoid bone movement between those who swallowed normally and those with tongue-thrust swallowing. In the normal pattern the hyoid was reported to move in an arc anteriorly, whereas in the tongue-thrusting pattern it moved in a diagonal direction anteriorly. In considering the influence of the hyoid bone position Straub (1961)

stated that during a child's growth, the tongue assumes a position farther back in the mouth as the hyoid bone drops. If the bone does not drop adequately, the tongue may remain in a more anterior position. Tongue position, according to Salzmänn (1971) plays a greater role in open bites than in the actual swallowing pattern itself. Hanson et al (1970) found a lack of relationship between the hyoid movement and type of swallow and indicates that more importance should be given to the intrinsic musculature in tongue-thrust.

Brodie (1962) states that tongue-thrust may occur as a normal and temporary part of growth and development until maturation of the lower face takes place (maxilla, mandible, orofacial musculature and the oral cavity itself). The lower face is rarely in balance or proportion until the individual is fourteen to twenty-five years of age.

Bosma (1963) agrees with Hoffman et al (1965) who advances the theory that the tongue may protrude at certain times in order to provide adequate pharyngeal airway space, essential to life, when the oral cavity is not yet large enough to accommodate the tongue and at the same time maintain an airway for essential respiration. The average child then from five to ten years has a child's jaw filling with adult teeth, and a large tongue in a relatively small mouth cavity. Most of the jaw growth and lowering of the hyoid bone, providing a larger oral cavity are yet to come. Some children have no place to put the tongue except outside the oral cavity.

Tulley (1969) in his investigation found that many patients are unable to effect an anterior oral seal with the lips at rest, therefore when the lips are "incompetent" the tongue comes forward to complete

the anterior oral seal. This theory is also upheld by Ballard (1959) who shows that when the dorsum of the tongue does not contact the roof of the mouth because of low posture tongue position, the resulting activity is for the patient to thrust the tongue forward to make an adequate seal. Staub (1951) feels that the perverted habit of tongue-thrusting may be aided by an unusually large tongue. Scott (1961) has also observed this disproportionality in size between the tongue and mandible even in the fetus.

Ortiz and Brodie (1949) also uphold this by their observation that at birth the mandible is also retruded relative to the maxilla and the tongue is large. This also supports a later study by Brodie (1962) which contended that at birth macroglossia is common and that the tongue completely fills the mouth and often the tip protrudes between the lips. He also states that the tongue cannot be trained to reposition itself if space is not available. In the early stages of development Subtelny (1965) says the tongue is anatomically large in comparison to the jaws and alveolar ridge. In other words the tongue has reached a proportionately larger size than the surrounding skeletal structures have reached in the early stages of life. Tulley (1969) agrees partially with this, feeling that the tongue size plays a part, but that true macroglossia is extremely rare. Goldberger (1973) states that tongue tie also restricts the action of the tongue and, therefore, can be a contributing factor to the tongue-thrust habit.

Tonsillar Tissue Theory

There is a paucity of information about the influence on the

child's behavior of extreme hypertrophy of the tonsils and adenoids. It has been the feeling of orthodontists that greatly enlarged tonsils may create or at least perpetuate certain forms of malocclusion and tongue-thrust habits. During the early stages of development, lymphatic (tonsil and adenoid) tissue in the oropharynx and nasopharynx has been shown to grow rapidly during the earlier years of life, according to Subtelny and Sakuda (1964) which can have effect on pharyngeal space, and frequently the tongue can be seen to be fronted or to assume a protruded position in children who have enlarged tonsils and adenoids. Ricketts (1965) has shown that a change in tongue posture can be noted subsequent to the surgical removal of the tonsil tissue.

Hoffman et al (1965) also states that tonsillar tissue in both the root of the tongue and the pharynx is at a maximum size at age eight to nine years. Sometimes a pharynx is filled with tissue which tends to push the tongue forward in order that the essential airway be kept open. In agreement with this Moyers (1958) feels that tongue-thrust behavior may arise from enlarged or hypersensitive tonsils. He also says that tonsils and adenoids, which are normally larger at this stage, may also be a factor and that hypertrophic tonsils and adenoids may cause an anterior adaptive displacement of the tongue, enhancing the thrusting mechanism and interfering with the normal maturational cycle of deglutition.

In a study done by Hanson et al (1969) large tonsils were found to be significantly correlated with tongue-thrusting in the four-year old population studied. They felt enlarged tonsils might contribute to the development of persistence in tongue-thrust by encouraging a

habitual forward placement of the tongue. However, according to the study by Ward et al (1961) she found that 78 percent of the children with a history of tonsillectomy were also tongue-thrusters.

Tongue-Thrust Innate at Birth Theory

The term innate applies to qualities or characteristics that are part of one's inner essential nature, existing or belonging to an individual from birth. It perhaps could be defined as a tendency present at birth, but not acquired or transmitted from the parents by heredity.

There are conflicting hypotheses in the literature as to the nature of the infant swallowing pattern. Shelton (1963) feels that the tongue-thrust swallow is the normal mode of behavior at least during certain stages of development. Bell and Hale (1963) also indicate that tongue-thrusting is normal at birth and tends to be replaced by the mature pattern later when the child has matured. Graber (1963) holds that the infant life begins with a well developed tongue-thrusting mechanism for the first six months of life, a transitional thrusting and lateral spread of the tongue during the next year and a dominant somatic type of swallow with the tongue contained within the dentition thereafter. In a study done by Lewis and Counihan (1965) they found that in 294 infants 97.2 percent showed tongue-thrust at birth. Neurologically, Kreig (1947) describes the swallowing reflex as being purely "reflexive and visceral" at birth progressing to a conditioned, somatic type of behavior pattern with maturity. Rix (1946) points out that tongue-thrusting is the retention of infantile characteristics which represented a delay in maturation of behavior. Mysak (1963) describes

the neonatal period of swallowing as a mouth opening and protrusion and subsequent retraction of the tongue. According to Fletcher et al (1961) tongue-thrust swallowing is the prevalent mode of swallowing behavior in children up to ten years of age. After this a marked decrease in the incidence of the tongue-thrust swallow takes place. Confirmation of this is advanced by Ward et al (1961) who states that tongue-thrust swallowing is a typical method of swallowing at the age level of children in grades 1 to 3.

Process of Maturation Theory

Early in the years of maturation the performances of mastication, deglutition and speech articulation are developed and modified by the rapid facial and oral morphological changes. The infant swallow is replaced by the emergence of the mature pattern of mastication and molar crush. These developmental processes are subject to abnormalities or deviations which might affect dependent functions such as swallowing or speech.

Studies by Findlay and Kilpatrick (1960) showed that this pattern of swallow changes as a function of growth and development. Werlich (1962) also agrees with this theory. Milisen (1957) in his study found that 15 percent of the children in kindergarten through fourth grade who have speech defects, have spontaneous correction up to the fourth grade but not much progress after that time. Irwin (1962) also supports the idea that growth, development, and maturation operate to permit better speech and spontaneous recovery from tongue-thrusting. Proffit and Norton (1970) state that with the eruption of teeth and

the addition of solid food to the diet, the infantile swallow is gradually replaced by a more adult swallow pattern. Changes in the pattern of swallow as a function of growth and development have been demonstrated by Baril and Moyers (1960). Their myographic, cineradiographic and electromyographic studies show marked within-subject variation in muscle activity patterns during deglutition in normal subjects.

In a later investigation Hanson et al (1969) agreed with Fletcher et al (1961) that the tongue-thrust behavior decreased with advancing age. Palmer (1968) also found that as the child moves toward an adult swallow, the jaws are brought more closely together while swallowing, tongue tip pressure increases and tongue-thrusting disappears. He also is of the opinion that retention of the infantile swallow into childhood would probably indicate neurologic damage. Gwynne-Evans (1952) also hold to this view and believe that tongue-thrust behavior occurs during infancy when the orofacial muscles are under the primitive control of the autonomic nervous system, and after maturation the orofacial musculature becomes innervated by the more sophisticated central nervous system.

In Tulley's investigations (1969) he also found that with growth and maturation, tongue-thrust can be observed at a later stage of development in only a small percentage of persons who showed protrusive tongue activity at an early stage. Winders (1968) and Wells (1968) agree that tongue-thrusting usually results from the child's failure to develop an adult swallowing pattern.

FUNCTIONAL THEORIES

Functional etiology can be identified as perhaps the improper function of normal structures whether by disease, growth, or defect. The formation of the oral structures would not show any abnormality, but a deviancy would be seen in the muscular function of these structures.

Akamine (1962) and Mendel (1962) in their studies found support that the tongue thrusts at least twice as heavily against the anterior dental segment in tongue-thrusters as in non tongue-thrusters; that the upper lip exerts half as much pressure in tongue-thrusters as in non tongue-thrusters and that the duration of these pressures from the tongue is about forty percent greater in tongue-thrusters than in non tongue-thrusters. The hypothesis is that these pressures are great enough and frequent enough to account for the abnormal oral structures thought to be related to tongue-thrusting. We can therefore see the great influence of improper functioning within the oral structures. Several theories have been advanced concerning the functional etiology.

Upper Respiratory Defects and Allergies Theory

Doty and Bosma (1956) in their studies have shown with electromyographs of animals that during swallowing, respiration and all oral manipulation are temporarily suspended by muscular inhibition. Upper respiratory conditions have been associated with the tongue-thrust open bite behavior. According to Barrett (1961) he found a high incidence of mouth breathing, allergies, tonsillitis and sore throats amongst tongue-thrusters. Sore throats or swollen tonsils are thought to

encourage the child to thrust the tongue forward during swallowing in order to favor the painful area. These chronic conditions reinforce abnormal swallowing habits. Hanson and Cohen (1973) found mouth breathing to be correlated significantly with retention of tongue-thrust. In agreement with this Ballard (1960), Bond (1960), and Graber (1963) also regard tongue-thrust as a behavior caused by upper respiratory defects and infections such as painful tonsillitis, pharyngitis, nasal congestion, allergies and by various structural defects of the oral cavity.

The hypotheses held by both Barrett and Harrington as disclosed by their lectures and communications, is based upon their observations of differences in the upper respiratory systems of their clients. They indicate that an open mouth condition may lead to an open bite swallow, difficulty in breathing, and other problems related to the upper respiratory tract.

Surgical Defects Theory

Brandt (1968) thought that faulty surgical procedures during tonsillectomies or certain childhood diseases, including polio, could paralyze throat muscles. This could be detected in patients not having a gag reflex. Such conditions result in abnormal swallowing patterns. Very little material appeared to be available on this subject.

Gap-Filling or Interference Habit Theory

This concept suggests that during the tooth-shedding years, between the ages of five and eight, the child learns to fill the space left by departing deciduous teeth with the apex or side of the tongue during swallowing to prevent escape of food from the oral cavity. After

the acquisition of new teeth, the conditioned behavior is retained and the result is malocclusion. The presence of tongue-thrust then will prevent proper incisor eruption, resulting in an open bite. This condition, in turn perpetuates the tongue-thrust.

Werlich (1962) in his research, upholds this theory, when he observed that the highest incidence in tongue-thrusting seemed to occur at ages five to eight years, the tooth shedding period. The case of adult developed tongue-thrusting according to Palmer (1962) would also appear to lend support to this hypothesis which shows how rapidly a minor habit may interfere with proper occlusion. In the early days of tongue-thrust investigation Tinsdale (1935) also associated the acquisition of tongue-thrusting to the mixed dentition period. In a complete examination by Staub (1951) he writes that it was found that the tongue plays an important part in an interference habit with normal growth of the dentition and is capable of causing many of our serious malocclusions.

Nursing and Feeding Habits Theory

Perhaps the most controversial hypothesis as to basic causes of the tongue-thrusting behavior is the nursing concept and habits theory. A deviant neuromuscular pattern of swallowing is said to stem primarily from bottle feeding.

Harrington in his lectures and Barrett (1961) and Staub (1951) suggest that in suckling (breast feeding) the infant develops strong elevation of the tongue and balanced exercise at each feeding which establishes a permanent pattern of swallowing and balanced mandibular

and lingual behavior, whereas bottle feeding (sucking) appears to make the nursing procedure overly easy, removing both the lingual and mandibular effort to some degree.

From his study of school children ages five to eight Werlich (1962) also showed that he would recommend a return to breast feeding or would advocate the use of techniques to make bottle feeding more natural. Staub (1951) and Picard (1959) maintain that nipples with large holes forces the infant to thrust his tongue forward to inhibit excess flow of nutrititon during swallowing. The perverted tongue-thrust swallowing habit is thus initiated. This abnormal reflex, repeatedly reinforced, becomes difficult to reverse once it strongly develops. They advocated short nipples that permitted a slow flowing of the liquid and that the infant sucked for a minimum of twenty-five minutes.

Andrews (1960) and also Meader and Muyskens (1950) ascribe atypical swallowing to early feeding habits. In an investigation of 237 patients who had the perverted swallowing habit, Staub (1951) came to a definite conclusion that the habit was due to improper bottle feeding and ten years later he still considered it to be a perseverative phenomenon of childhood resulting from improper feeding.

Barrett (1961) accepts the conclusions of Staub and Picard as the primary etiological factor in tongue-thrusting but he questions why all children fed with the conventional nipple do not have deviate patterns of swallowing.

There is some difference of opinion regarding nursing habits. Subtelny and Subtelny (1962) and Hanson, Barnard and Case (1969)

questioned the high correlation of tongue-thrusting and bottle feeding. Hanson et al reported a limited relation between bottle feeding and tongue-thrusting of five-year olds. Although he recognized their association, Subtelny doubted the strong relationship that change in function has on change in form.

In disagreement to the above studies, according to a study of preschool children done by Bell and Hale (1963) 82 percent were tongue-thrusting, 69 percent were bottle fed. However, on the normal swallowers 55 percent were bottle fed, so they felt that the percentage of bottle-fed over breast-fed children while large does not seem to be well correlated with the tongue-thrust behavior. Hanson and Cohen (1973) also agree that the contribution of bottle feeding to tongue-thrust does not support their study.

Cineradiographic studies were done by Rushmer and Hendon (1951) Ardran and Kemp (1955) and Ardran, Kemp and Lind (1958) all of whom investigated the feeding patterns of breast-fed and bottle-fed infants. They reported that the bottle feeding swallow was very similar to the swallow of the nursing infant.

Leech (1958) made a clinical study of orofacial behavior of 500 patients, a total of 94 had been bottle-fed. Forty-four of the 94 had atypical swallowing patterns, while the other 50 patients swallowed normally. He felt that no direct evidence was shown of atypical swallowing associated with lack of breast feeding. In their study Riechenbach and Rudolph (cited in Bijlstra 1958) found no significant relationship between duration of breast feeding in infancy and distal occlusion of the mandibular teeth. Bijlstra also reported no

significant relationship between breast or bottle feeding and maxillary protrusion in children 6-12 years of age.

Non-nutritive Sucking Habit Theory

It is considered normal for children to engage in non-nutritive sucking during infancy. This non-nutritive activity apparently is a comfort to the infant and gives a feeling of warmth and security with the additional sense of satisfaction.

According to Graber (1963) as other avenues of communication with the outside world develop, as other muscle systems mature, and as visual and auditory stimuli become meaningful, this non-nutritive sucking assumes less importance and these habits should spontaneously disappear.

Habits have played a strong role in tongue-thrusting and open bites. The persistent presence of a thumb or finger sucking habit relates highly to tongue-thrusting because it often persists after a finger or thumb sucking habit is lost. Years ago Teuschner (1940) also stated that he feels tongue-thrusting is a frequent substitute for finger sucking.

Staub (1951) and Walther (1960) and others have also considered other habits such as lip biting, nail biting and tongue sucking as possibly contributing to the tongue-thrust behavior. According to a study by Ward et al (1961) the tongue-thrust swallow was evident in a high percentage of children who sucked their fingers. However, on the other hand a large number of children showed tongue-thrust swallowing with a negative history of thumb sucking, therefore they did not feel these

factors were related.

The presence of an open bite at an early stage according to Subtelny and Sakuda (1964) should cause orthodontists to look for prolonged and intense use of the fingers and thumb. It has been their clinical impression that, in most instances, the tongue will adapt to its own environment; that is, the thumb or fingers created the orthodontic problem and subsequently the tongue has adapted to the problem.

Oral Fixation Theory

Little has been written in the literature relative to the tongue-thrust swallow being related to psychic disturbances. According to Palmer (1972) the oral fixation theory places the individual with a tongue-thrust pattern in the same group as individuals with emotional problems, especially those related to arrest at the so-called oral stage of psychological development. Tulley (1956) also refers to this theory and states that though it is mentioned it is advocated by few due to the fact that it has been common practice to refer clients with psychological problems directly to the psychologist for evaluation and therapy.

Neurological Damage Theory

It is reasonable to suppose that children mature at different rates in swallowing as they do in walking and talking, but we always find those who lag behind. In a study done by Proffit (1972) he found that if transition observed in his subjects was delayed beyond that of many children, and the infantile swallow was retained into childhood, this would indicate neurologic damage. Apart from Proffit's study

very little material was found in the literature concerning the neurological involvements of the infantile swallow. Fletcher et al (1961) and Gwynne-Evans (1952) appeared to support the findings of Proffit.

Chapter 4

SUMMARY AND CONCLUSIONS

In this study an attempt was made to (a) categorize the various etiological theories of tongue-thrust propounded in the literature over the past several years and (b) to coordinate the agreement, reserved agreement or disagreement of these theories among the investigators reviewed in this study.

The references indicated in this paper are not meant to suggest that the particular investigator cited believes only in that particular theory or explanation, or that he is unique in holding that viewpoint. Rather, it is to point out the current trend of thought on the prevalent theories of tongue-thrust etiology and to show what scholarly investigators indicate on the subject.

The following Table has been developed to try to give a concise summary of the materials reviewed in this paper, with an indication of the investigators' feelings or viewpoints on the particular theory advanced.

The variety of theories shown by Table 1 are indicative of need for further research regarding the etiology of the tongue-thrust swallow; for until tongue-thrust etiology is more adequately understood, therapy techniques will languish.

It would appear from this study that the highest number of agreements on any theory presented in this paper falls into the category of structural deviancy. Thirty-five percent of the researchers indicated

Table 1

Theories of Tongue-Thrust Etiology

	Hereditary	Structural deviancy	Tonsillar tissue	Innate at birth	Maturation process	Upper respiratory	Surgical defects	Interference habit	Nursing habit	Non-nutritive habit	Oral fixation	Neurological damage
Akamine		A										
Andrews									A			
Ardran, Kemp				A					D			
Ardran, Kemp,Lind				A					D			
Ballard	A	A				A						
Baril, Moyers					A							
Barrett	R	A				A			R			
Bell, Hale				A	A				D			
Best, Taylor								A				
Bijlstra									D			
Bosma		A			A	A						
Brandt							A					
Brodie		A			A							
Cauhepe	A	A										
Cole			R									
Doty						A						
Doty, Bosma						A						
Findlay, Kilpatrick					A							
Fletcher, Casteel Bradley		A		A	A			A				A
Garliner		A										
Goldberger		A										
Graber		A		A	A	A				A		

Key: A = Agreement
R = Reserved Agreement
D = Disagreement

Table 1 (continued)

	Hereditary	Structural deviancy	Tonsillar tissue	Innate at birth	Maturation process	Upper respiratory	Surgical defects	Interference habit	Nursing habit	Non-nutritive habit	Oral fixation	Neurological damage
Palmer	A	A		D	A			A			R	A
Picard									A			
Proffit					A							
Proffit, Norton		A			A							
Ricketts		A	A									
Riechenbach, Rudolph									D			
Rix				A	A							
Rushmer, Hendon									D			
Salzmann	A	A										
Scott		A										
Shelton		A		A	A							
Sloan		A										
Subtelny	A	A	A	A	A	A		A	R	A		
Subtelny, Sakuda		A	A							A		
Subtelny, Subtelny		A	R						R			
Staub		A			A			A	A	A		
Teuschner										A		
Tinsdale								A				
Tulley	A	R			A				D		R	
Walther										A		
Ward, Malone Jann Jann			D	A	R				D	D		
Weiss	A	A										
Wells	A	A			A							
Werlich					A			A	A			
Winders					A							

Table 2

Etiological Theories - Cumulative Scores

	A	R	D
Hereditary	8	1	-
Structural deviancy	32	1	1
Tonsillar tissue	7	2	1
Innate at birth	11	-	1
Maturation process	26	1	-
Upper respiratory	10	-	-
Surgical defects	1	-	-
Interference habits	8	-	-
Nursing habits	7	3	12
Non-nutritive habits	7	-	1
Oral fixation	-	2	-
Neurological damage	3	-	-

Key: A = Agreement
R = Reserved Agreement
D = Disagreement

Table 3

Etiological Theories - Percentage Scores

	A	R	D
Hereditary	9%	1%	-
Structural deviancy	35%	1%	1%
Tonsillar tissue	8%	2%	1%
Innate at birth	12%	-	1%
Maturation process	29%	1%	-
Upper respiratory	11%	-	-
Surgical defects	1%	-	-
Interference habits	9%	-	-
Nursing habits	8%	3%	13%
Non-nutritive habits	8%	-	1%
Oral fixation	2%	-	-
Neurological damage	3%	-	-

Key: A = Agreement
R = Reserved Agreement
D = Disagreement

that tongue-thrust was a temporary manifestation occurring intermittently during growth and development of the lower face. The investigation disclosed one percent reserved agreement and one percent disagreement with this theory.

Under the heading of maturation process, twenty-nine percent of the researchers felt that early in the years of maturation the performances of swallowing and speech are developed and modified by rapid facial or oral morphological changes. Therefore this pattern of infantile swallow will change as a function of growth and development. One percent had reserved agreement with this theory while there did not appear to be any definite disagreement.

Twelve percent of the investigators agreed with the innate at birth theory involving the qualities or characteristics that are part of one's inner essential nature (not acquired from the parents) and that the tongue-thrust swallow is the normal mode of behavior at birth and is later replaced by the more mature swallow. There was no reserved agreement on this theory but one percent definite disagreement.

Under the heading of interference habit or gap-filling theory, eight scholars felt that during the tooth shedding years the child learns to fill the space left by departing deciduous teeth with the apex of the tongue. This conditioned behavior is retained after the acquisition of new teeth. There did not appear to be any reserved agreement or disagreement with this theory.

Nine percent of the researchers agreed with the hereditary thesis that tongue-thrust is genetically transmitted from parent to offspring as has been shown by similar dental structures and the

particular type of maxillary or mandibular growth seen in both the parent and the child which is conducive to tongue-thrust. There was one percent reserved agreement with this theory and no definite disagreement.

Upper respiratory disorders was felt by eleven percent to be a causative factor. A high incidence of mouth breathing, allergies, tonsillitis and sore throats is prevalent among tongue-thrusters and these disorders are thought to encourage the child to thrust the tongue forward during swallowing. These chronic conditions would therefore reinforce abnormal swallowing habits. There was no reserved agreement or disagreement with this theory.

The most controversial theory of tongue-thrust appeared under the heading of nursing habits. Eight percent of the writers felt that bottle feeding leads to a deviant neuromuscular pattern of swallowing, which a child retains through the early grades. Three percent indicated reserved agreement with this theory while twelve percent indicated definite disagreement.

Eight percent of the researchers indicated that tonsillar tissue was the primary factor responsible for tongue-thrust etiology due to the fact that during the early stages of development, lymphatic (tonsil and adenoid) tissue in the oropharynx and nasopharynx has been shown to grow rapidly crowding pharyngeal space and causing the tongue to be grunted. Two percent had reserved agreement with this theory while one percent had definite disagreement.

Non-nutritive sucking habits were felt by eight percent of the

investigators to play a strong role in tongue-thrusting and open bites. They felt that persistent presence of a thumb or finger related highly to tongue-thrust, because it often persists after the habit is lost. There was no reserved agreement with this theory, but one percent definite disagreement.

Three percent felt that neurological involvements might be the cause of tongue-thrust; they indicated that children mature at different rates in swallowing as they do in any other muscular activity, but that some children lag behind and this would be indicative of neurologic damage. There was no reserved agreement or disagreement with this theory.

On the theory of oral fixation only two percent of the authors submitted a reserved agreement regarding the psychic disturbances relative to the tongue-thrust swallow. There was a paucity of information on this topic, and most writers did not indicate their feelings on the matter.

Material available on the theory of surgical defects was very minimal. Only one percent mentioned that faulty surgical procedures during tonsillectomies or certain childhood diseases could paralyze throat muscles precipitating tongue-thrust.

Discussion

After considerable research on the project this writer feels that the theory which appears to carry strong validity falls under the category of structural deviancy (though this in itself is difficult to categorize and separate from maturational or developmental processes).

It would appear that according to this theory the form of the oral structures determines the resting place and performance of the tongue and its musculature in infancy. As the deviant oral structure matures and develops to normalcy, so the tongue acquires a more retruded position in the oral cavity. The tongue appears to be a very versatile organ and adapts itself to its environment; therefore if the tongue is abnormally large in relation to the oral cavity, it accommodates itself to this limited area by assuming a fronted position. Any abnormal structural deviancy can produce an imbalance in tongue and lip activity, but as maturity develops and the oral cavity enlarges oral facial muscular imbalance is seen to decrease and is very minimally observed in the adult years as full growth is attained.

The study gives an overview of current thinking concerning causative factors involved in the tongue-thrust behavior. It should give valuable information both to the field of orthodontics and the field of speech pathology in developing:

- a. preventive techniques for implementation early in the life of the child who has tendencies towards the forward thrust of the tongue, which will also reduce family expenses involved in prosthetic procedures.

- b. meaningful counsel to young parents concerning feeding habits of their infants and how to encourage a stronger muscular action within the oral cavity to facilitate a strong normal swallowing action.

- c. more successful therapeutic techniques in the remediation

of the well established abnormal swallowing pattern and its involvements with malocclusion.

The study also demonstrated the fact that few researchers are willing to conclusively affiliate themselves with a particular theory (perhaps because this is not practical or possible). This writer feels that the study would carry more validity if each researcher listed could have been contacted individually for a more complete view of his etiological convictions and to have given his opinion on other etiological theories which were found in the research materials.

The blanks indicated in the charts are not a reflection of the researchers' lack of interest; they merely indicate an unknown.

It is obvious by the wide diversity of opinion presented in this paper that tongue-thrust etiology is at best poorly understood, inadequately investigated, and indicative of need for further research so that remedial techniques might be more successfully developed.

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LOMA LINDA UNIVERSITY

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TONGUE THRUST ETIOLOGY: A REVIEW OF THE LITERATURE

by

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A Research Study in Partial Fulfillment
of the Requirements for the Degree Master of
Science in the Field of Communication Disorders

June 1974

ABSTRACT

In recent years the attention of specialty groups has been drawn toward the peculiar oral behavior commonly referred to as tongue-thrust. This behavior is not only characterized by multiple symptomatology, but it also has been characterized by multiple terminology.

In addition to the wide variety of views and theories on the tongue-thrust behavior, there is an ever greater discrepancy of opinion concerning the causal factors of this behavior. What is its etiology? Is it a functional disorder? Is it organically based or a combination of the two?

The purpose of the study was to attempt to organize the most prevalent body of clinical investigation which has been submitted for publication or delivered at speech or dental conferences on the subject of tongue-thrust etiology. The paper endeavored to pursue all etiological possibilities and consider each theory propounded in order to arrive at a point of agreement, reserved agreement or disagreement between scholars who have done validated research and made a significant contribution to the field.

It is important to understand tongue thrust etiology because the tongue-thrust swallowing pattern has a high incidence in the general population primarily among school age children, especially in the lower grades. Increasing number of children with tongue-thrust also have defective speech and therefore serious consideration should be given to the causative factors related to it.

The study reviewed the major etiological possibilities for the deviant swallowing pattern commonly referred to as tongue-thrust. The main theories advanced by leading scholars were organized into two categories or organic and functional theories. A chart was formed whereby the various theories were listed and association of the theories with the researchers were coordinated so that at a glance it is possible to identify the harmonious or discordant thinking among leading writers regarding tongue-thrust etiology.

A review of the literature revealed twelve etiological theories pertaining to the tongue-thrust behavior. Of these the highest number of agreements involved 35 percent of the researchers and stated that tongue-thrust could be etiological attributed to a structural deviancy or a temporary manifestation occurring intermittently during growth and development of the lower face.

Twenty-nine percent felt that early in the years of maturation the performances of swallowing and speech are developed and modified by rapid facial or oral morphological change. Therefore this pattern of infantile swallow will change as a function of growth and development.

Twelve percent of the investigators felt that tongue-thrust was innate at birth, while eight percent felt that the tooth shedding years were responsible when the child learns to fill the space left by departing deciduous teeth with the apex of the tongue, therefore fronting the tongue.

Nine percent agreed with the hereditary thesis that tongue-thrust is genetically transmitted from parent to offspring as was shown by similar dental structures. Upper respiratory disorders was felt by

eleven percent to be a causative factor. The most controversial theory of tongue-thrust appeared under the heading of nursing habits. Eight percent of scholars felt that bottle feeding contributed to a deviant neuromuscular pattern of swallowing. Non-nutritive sucking habits and tonsillar tissue was felt by eight percent to play a strong role in tongue-thrust and open bites. Three percent felt that neurological involvements might be a cause, while on the theory of oral fixation only two percent of the scholars submitted a reserved agreement regarding the psychic disturbances relative to the tongue-thrust swallow. Surgical defects was felt by only one percent to be a causative factor.

The study should give valuable information both to the field of orthodontics and the field of speech pathology in developing (a) preventive techniques for implementation early in the life of the child who has tendencies towards the forward thrust of the tongue, (b) meaningful counsel to young parents concerning feeding habits of their infants and how to encourage a stronger muscular action within the oral cavity, and (c) more successful therapeutic techniques in the remediation of the abnormal swallowing pattern.

The study also demonstrated the fact that few researchers are willing to conclusively affiliate themselves with a particular theory (perhaps because this is not practical or possible). The study would also have carried more validity if each researcher could have been contacted individually for a more complete view of his etiological convictions and to have given his opinion on other etiological theories which were found in the research materials.

It is obvious by the wide diversity of opinion presented in the study that tongue-thrust etiology is at best poorly understood, inadequately investigated, and indicative of need for further research so that remedial techniques might be more successfully developed.