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THE ETIOLOGY OF THE PERVERTED SWALLOWING HABIT

WALTER J. STRAUB, D.D.S., M.S., SAN FRANCISCO, CALIF.

THE everyday observation of the orthodontist into the etiology of malocclusion has caused the desire to investigate more thoroughly the cause of the perverted swallowing habit. It is strange that very little appears in the literature regarding a habit that occurs with such frequency and causes such severe malocclusions. However, Truesdell and Truesdell[1] in 1937 advanced several theories on the cause of the perverted swallowing habit, although nothing has been published statistically to substantiate any theories on the cause of it. However, the literature is quite comprehensive on the act of deglutition. The word "deglutition" is derived from the Latin words *deglutitio and deglutire,* to swallow down, and is defined as the act of swallowing. It may occur during the ingestion of foods, either solid or liquid, or at periodic intervals throughout the day.

The purpose of this study is to survey the principal papers in relation to tongue habits and the cause of the perverted swallowing habit.

In order to understand the deviations from the normal, a thorough knowledge of the act of deglutition should be had and the following descriptions are generally accepted. Individuals whose teeth are in good or fairly close to normal occlusions close their teeth firmly in centric as the first step. The next action is the depression of the tip of the tongue and then placing the tongue in the palate well back in the mouth with the tip placed at the posterior part of the rugae. The tongue pressure is exerted backward and upward, the tip of the tongue in position and moving slightly distally. Naffziger, Davis, and Bell[2] stated: "The soft palate closes off the nasopharynx, the larynx rises and the opening is covered by the epiglottis as the material passes into the upper portion of the esophagus." Then deglutition may conveniently be divided into three stages. The first stage is both voluntary and conscious, during which the food is gathered into a bolus and carried into the isthmus of the fauces. The second stage is involuntary but still conscious, and may be considered a reflex mechanism, and the bolus or saliva is carried through the oral and laryngeal portions of the pharynx during this stage. The third stage is both involuntary and unconscious and the bolus or saliva is carried through the esophagus into the stomach. The Truesdells[1] gave a very good description of the act of deglutition:

"The muscles of mastication are brought into play in bringing the jaws tightly together and holding them there during the entire process. Thus the tongue has a firm boxing around it against which it can press and gain mechanical advantage in forcing the bolus distally."

The tongue raises the saliva or bolus of food and in its proper position has a complete boxing around it and obtains mechanical advantage with which to

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force the bolus, liquids, or saliva in the proper direction. From here the musculature used in swallowing is well described by Truesdell[1] and will not be repeated. The four openings to be closed in the act of deglutition are nasopharynx, the two internal auditory tubes, and the glottis. This also forms an additional aid in normal swallowing of a sucking action which, in addition to the pressure of the tongue, forces the liquids distally, although some people swallow with or without the sucking pressure. By the closure of the four openings and the sucking pressure, liquids can be swallowed upward, which is sometimes demonstrated in circus and side shows, such as contortionists, without the liquid running out of the nose or escaping its distal pressure.

In 1880 Kronecker and Falk[3] suggested that fluids and semifluids were projected by contraction of the muscles of the mouth (the mylohyoids) before the contraction of the pharyngeal and esophageal musculature occurred, and that this occurred later after the bulk of the bolus had passed and served to sweep along the remaining particles. Kronecker reported that at the beginning of deglutition there was a rapid rise of manometric pressure to 20 cm. of water in the posterior mouth, pharynx, and upper esophagus.

By means of roentgen-ray studies Cannon[4] in 1898 and 1900 came to the same conclusion in agreement with Kronecker and Meltzer that in the human being fluids were shot directly down to the cardia, mainly by the action of the mylohyoids and not by peristalsis, but that the swallowing of solids and semisolids was a slower peristaltic-like process. Cannon[4] described human swallowing of a solid bolus thus:

> When the food is sufficiently masticated it is gathered in a depression on the dorsum of the tongue. The tip and lateral aspects of the tongue press against the hard palate and teeth to prevent escape of the food particles forward and laterally to the mouth and cheeks. Respiration is reflexly suspended. The tongue is pressed upward and backward by contractions of the mylohyoid and hyoglossus respectively. The tongue thus acting as a piston drives the bolus first against the downward wall, sloping soft palate then on between this pharyngeal wall and the posterior surface of the upright epiglottis, the tip of which lies in contact with the base of the tongue. During this phase the action of the palato-pharyngeus muscles has thrown the pharynx into a narrow cleft and against this opening the soft palate is pulled by contraction of levator palati, thus blocking entrance of the bolus into the nasal chambers. Thus far the esophageal opening has remained closed mainly by pressure of the larynx against it. With the rise of the hyoid and larynx the esophagus opens. The epiglottis is pressed back until it shuts the laryngeal aperture. Then presumably the tip of the epiglottis slips downward along the posterior pharyngeal wall, pushing the bolus probably with a final quick impulse into the gullet.

Whether or not the action of the epiglottis is a factor in pushing the bolus is a point that was disputed as far back as 1892. Stuart Mosher[6] in 1927 published studies from which he concluded that the epiglottis acts as a cover for the larynx during swallowing.

Mosher[6] stated:

> In swallowing the first movement of the tongue is the depression of the tip. This makes a pocket between the tip of the tongue and the back of the teeth. In this the saliva or barium used in the experiment first accumulates. Next the dorsum of the tongue is hollowed out slightly and the barium flows into this depression. Then the tip of the

tongue is carried to the roof of the mouth against its teeth and is held there from now on, thus preventing the barium escaping forward. As the tip of the tongue comes up the base of the tongue is depressed. In the next stage the base is depressed still more, the anterior half of the tongue however goes to the roof of the mouth. The barium is now caught between the base of the tongue, the anterior half of the body of the tongue and the posterior pharyngeal wall. At this point the base of the tongue is seen to dart backward like the plunger of a piston and the barium is shot downward.

Barclay[7] stated that "time of swallowing is less than half a second with solids and probably less than one-fourth second with thin watery food.

"In swallowing we feel that the nasal cavity is suddenly automatically cut off and we note the change of pressure in the Eustachian tubes and that in swallowing the nasopharynx is completely emptied of air for a fraction of a second before we swallow, creating a suction that helps to slide the food down the esophagus after the tongue has thrown it into the pharynx and upper part of the esophagus.

"The act of swallowing must usually be accomplished by negative pressure. In my own case swallowing dry but masticated bread it amounted to 18 inches of water. The high negative pressure only lasted for about $\frac{1}{8}$ of a second but even so it was sufficient to carry the bolus from the back of the tongue to the level of the clavicle."

Best and Taylor[9]: "As a result of the muscular movements, chiefly on the mylohyoids a pressure of 20 cm. of water is developed in the posterior part of the mouth pharynx and upper part of the esophagus. . . . A negative pressure, however, exists in the anterior part of the mouth. A negative pressure also normally exists in the closed mouth at other times which aids in holding the lower jaw in the elevated position."

When the food is in the esophagus a negative pressure amounting to 35 cm. H_2O or more is created in the pharynx and esophagus, thus aiding in the descent of the bolus.

DESCRIPTION OF MATERIAL AND PROCEDURE

In discussing the perverted swallowing habit with a child's mother, in relation to one of her children, she expounded the theory that she thought the cause of her own child's perverted swallowing was bottle feeding. Her reasons and descriptions sounded so plausible that I, who had been gathering material on interference or pressure habits, decided to survey and keep a record of all patients coming into my office with the perverted swallowing habit.

In a period from June of 1943 to the time of writing, December, 1950, 237 patients presented themselves with perverted swallowing habits. A careful case history was taken on every patient presenting himself for orthodontic diagnosis. The general health, diseases to date, the recurrent attacks of such things as colds and allergy were all noted. Then the oral, orthodontic, or interference habits of the individual were noted. In most of these cases it was not necessary to ask the patient to swallow, as either the position of the teeth indicating the positioning of the tongue, or the patient would swallow involuntarily during the examination and the perversion noted as present.

In many cases, one or more habits would be present with the perversion. For example, thumb-sucking and a perverted swallowing habit would be present, or all the other habits that orthodontists are familiar with, such as leaning, lip biting, tongue thrusting, fingernail biting, sleeping habits, and pencil biting. The parents of children with perverted swallowing habits were interrogated as to the type of infant feeding, the length of time on liquid diet, and the correlation between infected tonsils, respiratory infections, allergies, duration of colds (Straub[10]), and correlation between endocrine disturbances and psychiatric problems.

TABLE I

		MALE	FEMALE	BOTTLE FED	BREAST FED	SUPPLEMENTAL FEEDING TWO TO THREE WEEKS
Total No. of patients	237	96	141	221	0	16
Age range 2-32						
Over 21 years of age	6					
Over 14 years of age	22					
Under 14 years of age	209					
Perverted swallowers with no contributing habits	107	43	64			6
Perverted swallowers with thumb- and finger-sucking	73	32	41			2
Perverted swallowers with all other habits	57	21	36			8

Table I shows the total number of perverted swallowers. It is interesting to note that only 16 had supplemental feeding and then for a short time only, and of these, only 6 had perverted swallowing habits without any other interference habits. The greatest percentage, 209, was 14 years or under.

In the observation of the act of deglutition there is not any change in the muscles of expression, and any observation of these muscles changing, just prior or during the act, usually indicates a perverted swallowing habit. However, as noted, the muscles of mastication are used in bringing the teeth and jaws tightly together and holding them during the entire process.

THE DESCRIPTION OF THE PERVERTED ACT OF SWALLOWING

In the perverted swallowing habit, the muscles of mastication are not used in bringing the jaws tightly together. First, the tongue is thrust forward between the teeth, and then the muscles of mastication bring the jaws together until the upper and lower teeth contact the tongue. In most cases only the tip of the tongue is involved with only an open-bite in the incisor and cuspid region. In others, the sides as well as the tip of the tongue are placed between the teeth, opening the teeth in the premolar region as well as the anterior teeth. The orbicularis oris and other facial muscles of expression enter into the act by tensing as if to help force the bolus back with the tongue. In many cases the patient blows air forward and builds up a positive pressure in the anterior part instead of a negative pressure. A wave of contraction starts with the facial

muscles, the tongue being held between the teeth, with a contraction of the muscles of the throat such as the palatoglossis, palatostyloglossis, and the mylohyoid. In addition to the contraction of these muscles, the patient also has a tendency to move his head forward during the first stage of deglutition as if to help roll the bolus or saliva backward. The act of deglutition takes place approximately one or two times a minute during the waking hours and approximately once a minute or less depending upon each individual's flow of saliva during the sleeping hours. The normal swallowing habit closes off, temporarily, the nasopharynx, the Eustachian tubes, the larynx from the pharynx, while the bolus of food is passing it. As previously described, this causes a partial vacuum which helps to drain part of the nasopharynx, part of the Eustachian tube, and also relaxes the muscles after the act. In the perversion, the reverse is true. The patient does not cause a complex vacuum but has a tendency to blow the remaining air against the openings, such as the lips, Eustachian tubes, and nasopharynx. In the perverted swallowing habit, the contraction is so intense that the patients have a strained musculature about the face and throat, whereas the normal act of deglutition is a very relaxing episode.

RESULTS

Of the 237 patients with the perverted swallowing habit examined, all of them without exception were bottle-fed babies. Sixteen were patients who were supplemental feeders for two or three weeks, who were put on the breast and bottle fed at the same time, for a period of two or three days to two or three weeks, when they were left solely on the bottle. A great many of these patients had affected the anterior segments of both arches. Either they had a severe so-called "open-bite" to a protrusion of the upper anterior teeth, or the anterior segments of both arches would be in a protruded position with spaces between the incisors and cuspids. Many of them, in addition, were thumb-suckers and had an extreme protrusion of their upper anterior teeth with little room to accommodate the tongue in its proper position in the palate, and instead it was found resting on the lower teeth. In fact in many of these cases the palate was so narrow and ill-formed that even if the patient wanted to put his tongue against the roof of the mouth it would not fit. The tongue would be too wide to fit flat against the palate.

As a result of the perverted swallowing habit we usually find a narrow upper arch and in a great many cases a severely contracted maxilla with protruding upper teeth in open-bite relationship. In other cases the maxilla is so badly contracted that either one or both sides are in cross-bite relationship. The importance of the proper position of the tongue against the palate with its boxing of teeth in the act of deglutition cannot be overstressed as it maintains the balance of forces to maintain proper arch width in the maxilla. In the perverted swallowing habit the opposite takes place and becomes very difficult to correct.

The perverted swallowing habit has been found by our investigation to be definitely due to improper bottle feeding.

In order to appreciate why bottle feeding can cause the perverted swallowing habit, a description of the differences of the mechanics of bottle feeding and breast feeding should be explained.

In breast feeding, the baby, in addition to his sucking at the breast, is pressing against the breast with his nose, cheek, and lips with the teat between his lips and gum pads so that there is a combination of pressure against the breast, a squeeze and a suck on the teat, and the tongue is free in the mouth to place itself properly to take care of the normal act of deglutition as the milk does not run freely but must be sucked out with pressure. When a mouthful is obtained the source of supply is shut off and the baby uses normal tongue action as described in the act of deglutition to throw the milk into the back of the pharynx.

In bottle feeding the nipple is very long and usually the parent wants to be sure that the child gets sufficient milk or the entire formula, without any effort on his or her part. To facilitate this procedure, there are usually several large holes placed in the nipple. There is no pressure used in bottle sucking and in order to prevent himself from choking from excess milk, the child's tongue is thrust forward with the tip between the gum pads and the nipple allowed to rest between the tip of the tongue and the upper gum pad and lip. The milk literally flows down his throat in the trough of the tongue, in which position he swallows. When the child attempts to suck vigorously, the milk comes so fast that he chokes before he can swallow properly or the parent has to remove the bottle from his mouth until he can either swallow the excess or it flows out at the corners of his mouth. The psychiatric problem of the baby nursing at the bottle should also be taken into consideration. Levy[11] stated, "Previous observation and clinical studies have demonstrated that the primary cause of thumb and finger sucking is insufficient sucking at the breast or bottle. In youngsters who suck after bottle feeding the nipple was replaced with one having one small hole increasing the sucking time to 25 minutes, which exhausts the sucking urge and the finger did not go to the mouth after feeding." Improper bottle feeding, in addition to causing the perverted swallowing habit, may help to cause finger- or thumb-sucking habits. If the child is fed from the bottle, he should be held by the mother so that he gets the love and affection and the warmth and soft feeling of the mother's body, and he should be made to suck and work for his food. The cold, scientific way of feeding, by placing the baby in his crib and using a chrome-plated bottle holder, or on his side, with the bottle resting on a pillow, soon teaches the baby to shove his tongue forward, maintain the tip in that position, and swallow the back portion of the milk with the perversion, while the tip is receiving a new supply of milk.

The love, care, and affection of the mother in nursing the newborn child at the breast should be copied as much as possible in bottle feeding. Interrogating mothers who have raised children in different age bracket groups where the older child was raised according to the old formula of feeding every four hours with a mechanical feeder, or the child lying in the crib with a bottle resting on the pillow as recommended in the past, and the younger children with the newer

concept of nursing with the bottle with the proper nipple and hole, where the child is cuddled, loved, fondled, and given his bottle when he cries for it instead of on certain hours, has brought out the following points. The mother is much happier, the child is better adjusted with a better nervous system and better feeling of security and well-being. Time will tell whether the perverted swallowing habit can be prevented by this method. A new nipple by Walter H. Griesinger,[12] of Portland, Ore., has many features which may help to correct this perversion.

COMMENT AND CONCLUSION

Methods for the correction of the perverted swallowing habit are described in the literature and there are several methods used in its correction.

However, may I caution that unless the operator is somewhat familiar with the perverted swallowing habit, the habit will be overlooked in diagnosing the case, and, when nearing completion, the operator will imagine that the patient has developed a perverted swallowing habit due to the new position of the teeth, and will instigate treatment to close up the anterior teeth, when, in reality, the habit had always been present, and, perhaps due to other habits, such as the leaning habit, the open-bite did not develop.

1. The perverted swallowing habit seems to be the direct result from improper bottle feeding.

2. The so-called open-bite is not always an indication of the perverted swallowing habit as other habits such as leaning habits may so affect the denture that they may disguise its presence and be present in a typical Class II, Division 1 with quite an overbite and overjet.

3. It may be present in tongue thrusters where they have pushed both upper and lower anterior teeth labially, creating spaces and in some cases an edge-to-edge bite.

4. The perverted swallowing habit may separate not only the anterior teeth but also most of the posterior teeth, including the premolars and in rare instances the first molar unilaterally.

5. In many perverted swallowers the palate is so high and narrow that the child cannot place his or her tongue in its correct position due to its size, even if the child wished to, until proper corrections have been made.

6. It may be present with other interference habits such as thumb- or finger-sucking, lip biting, tongue thrusting, nail biting, and leaning habits.

7. It seems to be more prevalent in the female than the male, but this should be discounted as parents may be more concerned with slight irregularities in their daughters' rather than their sons' teeth.

8. The perverted swallowing habit and tongue thrusting may be aided by unusually large tongues causing severe open-bite cases.

9. The perverted swallowing habit usually causes open-bite cases and if not corrected causes the anterior segments to relapse to their former position after the completion of orthodontic treatment.

10. It was found by complete examination that the tongue plays an important part as an interference habit with the normal growth of the dentition and is capable of causing many of our serious malocclusions.

11. The perverted swallowing habit should be detected and corrected early to facilitate normal development of the palate and dentitions. In its early detection it should be corrected immediately with a mechanical appliance to limit the tongue to its proper position. It is a very difficult habit to correct in older patients and there is some danger that after fourteen to sixteen years of swallowing incorrectly they may return to the old perverted swallowing habit after all appliances have been removed.

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