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RICHMAN- JULIA; Relationship of Infant Feeding Mode, Tongue Thrusting, and Lispings. (1967) Directed by: Dr. Helen Canaday. pp. 75.

Tongue thrusting has lately come under suspicion as a causative factor in orthodontic and articulation problems. A majority of investigators have agreed that the following symptoms indicate the presence of tongue thrusting: during the initiation of the swallowing act, there is contraction of the circumoral muscles, no contact of the molars, and protrusion of the tongue between the incisors. Although the etiology of tongue-thrusting behavior is uncertain, claims have been made that the way in which an infant was fed may have modified patterns of tongue activity to produce tongue thrusting.

Specifically, the argument is that the use of a nursing-bottle nipple with enlarged or multiple holes, or both, increases the flow-rate of the milk from the bottle to the degree where the infant in coping with the surplus supply must make adaptive tongue movements both to check the flow of milk and to keep from choking while swallowing. The adaptive movements become a habitual pattern, and the nature of the adaptation - the tip of the tongue forward and protruding, with the back of the tongue up high to block the entrance to the throat - is believed to be the basis of deviant tongue behavior during swallowing.

It was the aim of this study to investigate the extent of the association between feeding with nipples with enlarged or multiple holes, and four of the alleged consequences of this feeding mode: tongue thrusting during swallowing, tongue thrusting during speech, general defective

articulation, and one aspect only of defective articulation, lisp-
ing.

A survey was made of the presence of these four behaviors in 159
three- to five-year-old nursery school children. Information about early
feeding history was supplied by the mothers of the children. Mode of feed-
ing was correlated with the incidence of the four factors under investiga-
tion. The results were not statistically significant, and the conclusion was
drawn that claims for the consequences of this specific mode of infant feed-
ing could not be supported by the data gathered in the present survey. It
was further pointed out that feeding mode must be regarded as only one
factor among a complex of interacting variables influencing tongue thrust-
ing and defective articulation. The nature of other influences was discussed.

Because future investigation of tongue thrusting is handicapped by
the scantiness of information about early feeding mode, it was recom-
mended that questions about manner of infant feeding be included in initial
interviews with parents by all who work with young children. The need for
long-term studies to supplement cross-sectional studies was emphasized.
Further research is needed in the following specific areas: standardized
criteria for tongue-thrusting symptomology; spontaneous resolution of
tongue thrusting; neural and motor factors underlying both tongue thrust-
ing and defective articulation; tongue thrusting in other cultures; the per-
sonality of the mother of the tongue thruster.

RELATIONSHIP OF INFANT FEEDING MODE,
TONGUE THRUSTING, AND LISPING

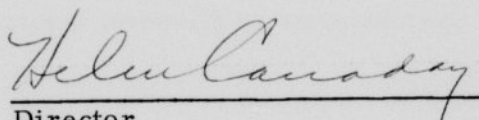
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Chapter I

Introduction

Importance of the study

All structures and processes in the human body arise from previously existing ones. The newly arising and more complex structures and functions incorporate in part those that preceded them; thus the older, earlier forms of activity may often become determining factors which to some extent shape succeeding development (Meader & Myskens, 1950). As a form of behavior that has been subject to environmental and physiological influences during a lengthy course of maturation, speech is dependent upon the degree and nature of the previous growth that has taken place in the organism (Bloomer, 1963). In the period before the emergence of meaningful speech, structures of the human body which comprise the speech apparatus have been serving the basic biological functions of sucking and swallowing. In the present study, it will be proposed that during this prior use, as the outcome of the environmental opportunities to which his inborn capacities have been exposed, the individual has developed neuromuscular patterns which are unique to him. It will also be proposed that these earlier patterns of behavior may have modified subsequent development in the orofacial region. A search will be made for indications that deviance in the later dependent activity of speech superimposed upon these parts may reflect deviant

development of the earlier neuromuscular functioning in this area.

Speech faults and orthodontic difficulties are considered of sufficient importance to watch for, to test for, and, when they appear in a child, to correct if possible. Rather than waiting until the child presents these problems, it would seem equally important to attempt to disentangle possible factors in their etiology with a view toward prevention. Yarrow (1964, p. 130) has summarized the essentials of this approach: "Just as we recognize the complexity of . . . development, so we must also recognize that many factors in complex interaction determine the extent to which damage from adverse early experience can be modified by later events, or by special therapeutic techniques. If we are able to identify etiological variables with greater precision we can manipulate more effectively situations to prevent . . . damage as well as to develop specific therapeutic techniques."

Specifically, evidence will be sought to show that function in the orofacial area becomes dependent to an ascertainable extent upon a type of bottle feeding which allows milk to flow so rapidly from nursing-bottle nipples that the infant is compelled to adapt to two situations: 1. He must cope with surplus milk during swallowing and respiration. 2. He has neither the need nor the opportunity to practise vigorous suckling. In the context of a discussion of inborn needs, Erikson (1950, p. 76) posed a pertinent question: ". . . are there potential patterns which cannot be ignored or reduced beyond a certain minimum without

risking deficiencies, but which on the other hand must be provoked in specific ways by environmental procedures to be promoted to full development? "

The reason for undertaking the present study may thus be stated: if causative factors of deviant behavior can be identified, they should be studied from the time they begin to operate, not retrospectively after the damage has been done. The emphasis of this investigation, therefore, will be upon an attempt to isolate a specific situational factor from the multiplicity of variables affecting oral and articulatory development. It is not, however, a study of articulatory, orthodontic, or deglutition difficulties; the focus is upon exploring one practice in infant feeding, the enlargement or provision of multiple holes in nursing-bottle nipples, to ascertain contributing factors to problem behavior in these three areas.

In the artificial feeding of infants, attention has been largely directed toward providing adequate nutrition, and little importance has been attached to the manner in which the infant gets the milk out of the nursing bottle. Larr (1962), Meader & Muyskens (1950), Picard (1959), Palmer (1962), and Van Riper (1963), have viewed with misgiving the common practice of enlarging the nipple hole to increase the flow-rate of milk from the bottle, and have published speculations about the possibly adverse consequences of such a procedure. Yet no systematic study of this specific feeding mode could be found in a search of pediatric, orthodontic, or speech pathology literature. To replace conjecture

by factual information, the effect of the enlargement or provision of multiple holes in nipples was chosen for investigation.

It was chosen also because it was an event verifiable objectively by direct observation, and because it was a process presumably open to change. Determinants of behavior may be classified as either overt or covert; the overt factors are those ascertainable by direct observation; the covert factors require subjective judgment both to establish their existence and to estimate the degree to which they are present. Some of the covert influences which modify oral and speech behavior are genetically determined and are for all practical purposes unchangeable. These include level of motor ability (Dickson, 1962; Prins, 1962); sound learning ability; hearing ability; intelligence, (Prins, 1962; Winitz, 1964); size, shape and mobility of the tongue (Subtelny, 1965); neural dysfunction or delay in neural maturation (Bloomer, 1963); force of muscle pressure and hardness of bone (Ward, Malone, Jann & Jann, 1961). Other covert influences may presumably be changed but with difficulty, and present measurement of these influences is nebulous; factors such as emotional and social adjustment, personality of the mother (Dickson, 1962; Irwin, 1960), and cultural norms (Van Riper, 1963) belong in this category.

This is not to imply that covert factors do not have equal or greater importance in the development of tongue-thrusting behavior and defective speech, but it seemed more feasible to approach the problem

by investigating one overt, partially mechanical aspect of feeding mode, the use of nipples with enlarged or multiple holes. Nor was it the intent of this survey to attribute deviant functioning to one antecedent environmental factor only. Irwin (1960, p. 299) has termed such an approach the "unidimensional fallacy." Everhart (1953) has pointed out that acceptable articulation patterns are the result of numerous complex elements; competency cannot be regarded as dependent upon any one variate. Matthews (1957) has stressed that all processes in speech production must synchronize; interference with any part of the complex operation may result in faulty speech. Therefore, it must be clearly stated that in the view of this investigator, causative factors are generally not single, but multiple and complexly interrelated. No claim is being made that the feeding condition studied in this survey is the sole antecedent factor in the emergence of tongue-thrusting behavior or defective articulation.

Scope and limitations

The scope of the present study was limited to a comparison of the incidence of tongue thrusting during swallowing, tongue thrusting during speech, and defective articulation (later narrowed to one aspect of articulation, lispings), under two conditions of infant feeding: feeding condition 1 (FC 1), in which children studied had been fed through nipples with enlarged or multiple holes, or both, and feeding condition 0 (FC 0), in which children had not been fed in this manner.

Under FC 1 were subsumed the following conditions: subjects bottle-fed from birth with enlarged or multiple holes, or both, in the nipple; subjects who had a trial of breast feeding for less than one week and who were subsequently bottle-fed with enlarged or multiple holes, or both, in the nipple.

Under FC 0, the following conditions were subsumed: subjects breast fed from birth, then weaned to a cup, not to a bottle; subjects who had a trial of breast feeding for less than one week, then were weaned to a bottle with no enlargement of the hole in the nipple nor provision of additional holes; subjects bottle-fed from birth with no enlargement of the hole in the nipple nor provision of additional holes.

The scope of the present study was further limited by confining observations to subjects who met the requirements to be presented in detail in Chapter III; that is, they were all hospital births, they were children capable of functioning in a group situation, and they fell within the age group of 3 through 5 years.

Other limitations operate to make this and any other study that includes tongue thrusting inconclusive. Currently, there are no available standards to evaluate differences in tongue morphology (Hedges, McLean & Thompson, 1965). The contribution of the size, shape, and mobility of the tongue to the tongue-thrusting situation therefore cannot be accurately assessed, nor has the normal range of differences in respect to the tongue been defined. Hoffman and Hoffman (1965) have

called attention to the need for studies of the size of the tongue in relation to the proportional size of the oral cavity at successive stages of growth. Since the development of the lower face is rarely in perfect balance until adolescence, and may not be complete until as late as the age of twenty-five (Brodie, 1962, in Hoffman & Hoffman, 1965), information about tongue thrusting until the end of adolescent growth is needed to coordinate with the maturation studies.

A final limiting factor in the achievement of definitive studies of this problem is the inadequacy of present-day technology to the task of measuring the pressure exerted by the tongue during thrusting (Jann, 1960; Ward et al., 1961; Subtelny, 1965). No method has yet been developed for estimating the force and duration of the thrust, which may be a key variable in the consequences of tongue-thrusting activity.

Operational definitions

Suckling from the breast: In suckling, the orbicularis oris, the sphincter-like muscle that encircles the mouth, acts as a light seal against the breast. There is no tight pursing action of the lips, and the cheeks are kept from being pulled in by fat pads on the buccinator (inside cheek) muscles. The infant sucks a large area of the breast around the nipple into the mouth; pressure on these tissues surrounding the nipple itself stimulates movement of milk from the interior of the breast to the nipple. Flattened and elongated by this suction, the nipple presents a large area to the strong stroking front-to-back movement of the tongue.

There is strong forward and backward mandibular (lower jaw) action, and a strenuous squeezing, upward, stroking action of the tongue tip. Negative pressure in the oral cavity plus upward pressure exerted by the mandible expels milk from the nipple into the baby's mouth. After each squeeze, while the infant swallows and takes a breath, there is instant cessation of the milk supply due to cessation of tongue action and mandibular action against the nipple (Andrews, 1960; Palmer, 1962; Picard, 1959; Straub, 1960).

Sucking from nipples with enlarged or multiple holes: The enlargement of the nipple holes cannot be described precisely since it was not a factor available for measurement. In general terms, since the purpose of creating a larger hole was the same in every case, to hasten the flow of milk, it is assumed in this study that each such event had a roughly equivalent outcome. In some cases a heated needle was used to enlarge the original nipple hole or to punch additional holes around it. In other cases a small crosscut (as in nipples used for premature infants) was made (personal communication from mothers).

In sucking from a nipple with a large opening, there is no mandibular action nor are there strong stroking movements of the tongue. Instead of being forced out in spurts which cease instantly when the baby stops the sucking activity, milk flows freely as when sipped through a straw, and continues to flow during swallowing and respiration (breathing), interfering with these functions. The posterior (back) part of the tongue remains up against the soft palate to prevent choking, and the

anterior (front) part of the tongue drops forward (Andrews, 1960; Picard, 1959).

Normal swallow: During the normal act of swallowing, the masseter and temporalis muscles which control the hinge-like action of the lower jaw, contract, bringing the posterior teeth firmly together. Lips and cheeks remain relaxed. The food or saliva to be swallowed gathers into a depression on top of the tongue. The tip of the tongue is positioned on the alveolar (gum) ridge just behind the upper front teeth. As the body of the tongue exerts pressure upward and backward against the palate (roof of the mouth), the bolus (that which is being swallowed) is moved back. When it reaches the pharyngeal cavity (the back of the throat between the mouth and the esophagus), it is carried down into the esophagus (the tube leading from the pharynx to the stomach) by a wave of squeezing reflexes. The tongue action and the tongue pressures are upward and backward. The tongue should not protrude beyond the confines of the oral cavity (Larr, 1962; Fletcher, et al., 1961; Hedges, et al., 1965; Ward, et al., 1961).

Tongue-thrust swallow: The tongue is not oriented prior to swallowing on the gum ridges behind the upper teeth. There is little or no palpable contraction of the masseter muscles to bring the posterior teeth together. Tension may be observed in the mouth-enclosing musculature; the orbicularis oris and other mouth-encircling muscles act in sphincteric (pursing) behavior. There may be extreme difficulty in swallowing when the mouth is forced open by pulling down the lower lip thus

abolishing the labial seal (tight approximation of the lips). During the actual act of swallowing, a forward thrust of the tongue pushes it between and beyond the edges of the upper and lower incisors (Fletcher, et al., 1961; Ward, et al., 1961).

Tongue thrusting during speech: This behavior is manifested in extra muscle activity primarily of the cheeks, in upper incisor protrusion and possibly lower incisor protrusion, in a recessive mandible, and in lingual protrusion during the initiation of the swallowing act (Vanella, 1966, personal communication).

Defective articulation: Articulation is the modification of the air-sound stream which proceeds outward from the larynx. It is achieved by squeezing, interrupting, or modulating by a complete or partial constriction of the passageway (Van Riper, 1958). Certain articulatory movements can be said to be typical or essential to the production of a given sound. When acoustic end results are atypical, articulation is defective (West, Ansberry & Carr, 1957); it is defective when there is omission, substitution or distortion of speech sounds (Van Riper, 1958); defective articulation "reflects a failure of the speaker to achieve a normal pattern, timing, and accuracy of the speech articulators (tongue, lips, and palate) as they move in reference to the structural framework of the mouth and face." (Bloomer, 1963, p. 925)

Normal /s/ sound: The /s/ sound is an unvoiced, tongue-tip, alveolar, continuant, fricative produced by directing a strong stream of air

forward along the grooved midline of the tongue, thence across the cutting edge of the incisors. The tongue is the primary agent. A special articulatory adjustment is made as follows: the upper lip is slightly lifted, the lower lip is slightly depressed and everted, and both lips are drawn back exposing the edges of the incisors. The mandible is adjusted so that the upper and lower central incisors almost touch. The tongue is lifted in its entirety; the sides of the tongue block the oral outlet laterally, as far forward as the upper premolar teeth, while the tip and the front (which avoid contact with flesh or dentition) turn up toward the alveolar ridge behind the upper incisors. Alternately, the tip may brace against the base of the lower incisors with the front alone toward the alveolar ridge. The channel made in the tongue by contracting the raised tip or front allows air to be forced strongly between the incisors. The velum (soft palate) and the pharyngeal wall are approximated to close the posterior nasal port (Van Riper, 1958; West, Ansberry & Carr, 1957; Vanella, 1966).

Lisping: Lisping is classified as one of the distortions comprising defective articulation. In central or interdental lisping, there is faulty articulation of the /s/ sound due to the lowering of the jaw so that the teeth are some distance apart, followed by protrusion of the tongue tip and contact of the tongue with the incisors. This may also occur in open-bite. The sound produced approaches /th/. In labio-dental lisping, the lower lip comes in contact with the cutting edges of the upper incisors,

and the sound produced approaches /f/ (Van Riper, 1958; West, Ansberry & Carr, 1957).

Purpose of the study

The present study was undertaken to compare the incidence of the factors of tongue thrusting during swallowing, tongue thrusting during speech, and defective articulation (later narrowed to one of its aspects, lisping) among children whose earliest feeding experience included either enlargement of the nipple hole, or provision of multiple holes in the nipple, or both (to expedite the flow of milk from the nursing-bottle), with the incidence of the same factors among children whose feeding history did not include this experience.

Hypotheses

Hypotheses were formed regarding the direction of the relationships between the factors under examination in this paper and the feeding conditions which have been described, the data to be obtained by procedures which are presented in Chapter III.

Hypothesis I. There is no difference in the incidence of tongue-thrusting behavior during swallowing between children whose early feeding included the use of nipples with enlarged or multiple holes or both, and the children who were not fed by this method.

Hypothesis II. There is no difference in the incidence of tongue-thrusting behavior during speech between children whose early feeding included the use of nipples with enlarged or multiple holes or both, and children who were not fed by this method.

Hypothesis III. There is no difference in the incidence of defective articulation between children whose early feeding included the use of nipples with enlarged or multiple holes or both, and children who were not fed by this method.

Hypothesis IV. There is no difference in the incidence of lisping between children whose early feeding included the use of nipples with enlarged or multiple holes or both, and children who were not fed by this method.

Theoretical background of the study

Primacy of oral cavity. As the first area to register sensory impressions in the cortex, the complex structures and functions of the oral cavity constitute the primary center of perceptual function. Tongue, cheeks, lips, palate, pharynx, and larynx contain an intricate network of afferent motor nerve endings which constantly stimulate motor impulses to the muscles of these parts regulating their functions (Stolzenberg, 1962).

Principle of individual differences. Development of the human body is an interaction of genetic and environmental factors. Environmental stimulation plus the unique response of each individual to each specific stimulus are the conditions that give direction to growth, making each human being a unique and unrepeatable event (Caldwell, 1964; McClearn, 1964).

This principle of individual differences has important implications

for the present study. Since genetic endowment may be regarded as potential which is activated by environmental opportunity, it is possible for the development of soft tissue, bony structure, and muscle function to be modified by external situations. Thus the neuromuscular dynamics of the basic biological functions of the oral cavity which develop uniquely for each human being have much to do with the actual formations in that area (Jann, 1960).

A second implication of the principle of individual differences is that a wide range of human behavior must be included in any concept of normal or deviant neuromuscular patterns in any region of the human body. Specifically, since a major muscular activity of the newborn infant is the intake of milk, the conditions of stimulation which elicit the first sucking response may modify neuromuscular patterns in a way that affects subsequent sucking behavior. Important questions are: How much of this adaptive behavior can be classified as normal? At what point does the behavior become deviant?

Role of feeding mode in conditioning orofacial behavior. When learning is defined as a change in performance which occurs under the conditions of practice (Breckenridge & Murphy, 1963), sucking may be classified as a learned activity which varies according to feeding mode experience. Natural nursing reflexes diminish rapidly when nipple feeding replaces breast feeding, and true suckling behavior is supplanted by sucking (Picard, 1954; Sears & Wise, 1950). (Sucking from a nipple is

characterized by lack of mandibular action and by a pattern of tongue movement and posture that differs markedly from suckling from the human breast.) The publication of recent studies in this area has given impetus to considerable discussion of the part played by bottle-feeding in conditioning orofacial behavior (Hoffman & Hoffman, 1965). Investigators have proposed that the type of rubber nipple in general use may be a contributing factor toward so-called deviant tongue patterns which have been variously labelled: tongue thrusting, reverse swallowing, deviant swallowing, visceral swallowing, orofacial muscle-pressure imbalance, infantile swallow, transitional swallow, teeth-apart swallow, or atypical swallow (Palmer, 1962; Tulley, 1956).

Tongue-thrusting syndrome. Tongue-thrusting descriptions have varied from one report to another. The concurrence of the following symptoms appears widely in the literature: tongue placement against or through anterior dentition at rest, during speech, and/or during swallowing; a tight labial seal indicating overactivity of the orbicularis oris (muscle encircling the mouth) and the mentalis (chin) muscles, with difficulty in swallowing when this labial seal is abolished; a lack of contraction of the masseter muscles in bringing the posterior teeth together (Fletcher, et al., 1961; Ronson, 1965). Since its recognition as a clinical entity, "tongue thrusting" has been the term most frequently used to designate this combination of symptoms.

Association of tongue thrusting and other functions. Since speech is dependent in part on structures and mechanisms whose basic biological functions are sucking, chewing, and swallowing (Barrett, 1961), deviant development of the earlier functioning of these parts, which comprise the speech apparatus, may contribute to defectiveness in the later overlaid function of speech. The unusual stresses identified with tongue-thrusting activity have also been suspected of contributing to open-bite, another development associated with defective articulation, particularly of the /s/ sounds (Travis, 1957).

Summary

The importance and purpose of the study, definitions of terms, and scope have been presented in Chapter I. A statement of hypotheses and an outline of the theoretical background concluded this section of the study.

Organization of the remainder of the thesis

A review of related literature from the fields of infant feeding, dentistry, and speech pathology is presented in Chapter II. Chapter III includes a description of the requirements for the selection of subjects, the criteria used to determine the presence of the variables under observation, and a description of the actual processes of data collecting. Statistical analysis of the data and a statement of findings are reported in Chapter IV. Chapter V offers conclusions based upon the findings with suggestions for further research. A summary concludes the study.

Chapter II

Review of the literature

Reports included in the review of the literature range from clinical impressions to systematic studies. Their value as research must be assessed accordingly. A reminder of the known ability of the human organism to adapt successfully to even extreme anomalies in structure and function of any part of the body, further restricts uncritical acceptance of findings of these or any other studies based upon supposedly unchanging variables of human behavior.

Selected research which pertains to the following aspects of the problem will be examined: (a) material indicating that neuromuscular patterns, which vary in response to differing conditions of stimulation of the sucking reflex in the newborn, may play a part in the growth of the orofacial area, shaping bony structure and causing other structural as well as functional changes; (b) material indicating the existence of a clinical entity or combination of symptoms terms tongue thrusting, which is regarded as a deviant behavior pattern associated with lisping and other defective articulation; (c) material exploring the etiology of tongue thrusting with specific reference to its association with early infant feeding modes.

Environment shapes growth

As a general proposition, it is axiomatic that events early in the

life of a developing organism are important to growth and development in later life. What is given is the genotype which functions in a setting of environmental situations (Breckenridge & Murphy, 1963). Thus, although the capacity for individual adaptation is genetically determined, behavior (unique responses to external opportunity) reflects the extent to which this capacity has been permitted to develop. Complex interaction between situational factors and changing needs which are modified by, as they in turn modify, environment leads to the central concept of constant reciprocal change in both the individual and his environment. Each human being therefore is the product of an environment which never can be duplicated.

For the purposes of this paper, answers, even though partial, are being sought to these questions: Which early events give evidence of close association with what later behavior? Can an assessment be made of proportional responsibility among the various factors contributing to deviance? Can the kind of stimulation required to bring about favorable development of neuromuscular patterns in the orofacial area be identified?

Response to feeding situation. Studies from pediatric, orthodontic, and speech literature have produced evidence suggesting that early postnatal sucking opportunity can be a factor in modifying suckling behavior. Tulley (1956, p. 802) stated that "the circumoral muscles originate as primitive elements forming the upper end of the

alimentary canal and are initially concerned with the vegetative function of feeding. The basic pattern of their behavior becomes established before birth and suckling movements have been shown to occur in utero." Subtelny (1965) also alluded to the belief that there is a prenatal establishment of relationships and postures which is correlated with the mechanisms of suckling. He referred to evidence that the function of suckling "has been learned by the fetus prior to birth since everything is ready for suckling as well as for breathing at birth" (Subtelny, 1965, p. 63).

Rapid modification of this basic pattern of suckling has been shown in studies by Fredeen (1948), Davis, Sears, Miller and Brodbeck (1948), Sears and Wise (1950), Blau and Blau (1955), and Meyer (1958). For a period of ten years, Fredeen made it his practice to substitute cup or glass feeding from birth to obviate propped bottles, to compel nurses to pick up and hold the babies thus stimulating the close contact which accompanies breast feeding, and to eliminate the frustrations of weaning. The cup was placed against the lower lip and over the tongue. The babies learned in a few feedings to swallow the milk which was poured in as fast as possible. All sucking movements eventually ceased.

In a study of feeding behavior during the first ten days of life, Davis, et al. (1948), divided 60 babies into three groups of 20 each. There was no randomization; the mother of each child chose a group. Group 1 was fed by cup, group 2 by bottle, and group 3 by breast. Although 20 minutes of feeding time was allowed in each group, the cup

and bottle babies were finished in half this time. The group on breast feeding developed the strongest sucking reflex during the ten-day period. The investigators used "very pliable nipples that required little vigor in sucking but this factor was not measured" (p. 557). How quickly the human organism responds to environment is demonstrated in this description of procedure. During cup feeding, milk was poured into the baby as quickly as it could be swallowed. The cup was placed as in the Fredeen study against the lower lip and on top of the tongue. Reflex sucking which is often stimulated by touching a baby's mouth had diminished or disappeared by the tenth day. As skill in swallowing increased, feeding time decreased. The baby was given no opportunity to rest nor to refuse to drink. Sensory contacts were minimal by this method, including only the lower lip and the tip of the tongue, as compared to the stimulation of the lips, tongue, gums, palate, cheeks, chin and nose in breast feeding, plus the warmth, smell and pulsation of the breast. Sears and Wise (1950) extended the investigation of cup feeding after Fredeen's method to 80 babies from their own private practice. They found that ready-made infantile responses waned if unused for too long a time and that sucking movements disappeared.

The lesser stimulation afforded by bottle or cup, as well as the actual mechanical differences requiring a different muscular posture from the parts involved, together bring about changes in muscle function in the sucking and swallowing apparatus. That these mechanical

differences may often be completely overlooked is apparent in the study by Blau and Blau (1955) who compared long versus short feeding periods of sucking in an attempt to relate length of feeding time to thumbsucking. In observing one baby almost around the clock (the only feeding not observed was the 2 a. m. feeding) from the age of three weeks to the age of seven weeks, they assumed that the mechanics of two different feeding methods were identical. The experimental variable was slow feeding with a regulation nipple compared to fast feeding with a nipple with many extra holes. Although they attempted careful control of many variables in the design of the experiment, they did not regard the baby as an interacting developing organism, despite the adaptation that must have taken place to the two alternating modes of feeding. Maturation factors, implicit in four weeks of growth, were also neglected.

Meyer (1958) noted strong suckling movements which are reflex in newborns, and which he tested by putting his finger into the infant's mouth. He observed that these reflex movements waned in bottle-fed babies after a few days. Since he did not comment on breast-fed babies, it is not made clear in his report whether a similar finger-in-mouth test was used with them. One must consider that the babies may have begun to recognize that a finger is not a nipple and may not have employed full sucking energies on a finger.

Incidence of breast feeding. To compare the incidence of breast feeding in the population used in the present study with incidence in the

in the national population, a search was made for normative data. Wide fluctuation was found between different regions of the United States and between different periods of time. Caldwell (1964) commented that figures accurate as recently as five years ago would not be valid today. In a national survey in 1948, Bain (1948) found that 65% of mothers were nursing at the time of their discharge from hospital. Meyer (1959), on the basis of a national survey in 1956, reported that 21% of mothers were nursing compared to 38% in 1946. In both the earlier and later surveys, marked regional differences were noted, and a consistent decline in all regions between the earlier and later decades.

Salber and Feinleib (1966) found wide variation with social class. They referred to a 1930 study by Garland and Rich in which the greatest incidence was discovered in low socioeconomic groups; a similar finding was made in 1946. In 1955, Salber found greater frequency of breast feeding in middle socioeconomic groups than in low. In a comparable study in 1957-58, (Salber, Stitt and Babbott, 1958) greater frequency of breast feeding among mothers of high socioeconomic status than among mothers in either the middle or low socioeconomic groups was reported.

Muscle action affects bony structure. Many studies have affirmed the role of soft tissues in shaping the facial bony structure. Examining the diagnostic significance of what he termed "adverse muscle forces," Tulley (1956) directed attention to the role of the tongue and circumoral muscles in malocclusions. As the teeth erupt, they reach a position in

balance between the "normal or abnormal lingual and labial muscle forces" (p. 801). Jann (1960, p. 81) stated that the "form and shape of the hard structures is dependent on the functions and uses to which they are put by the soft structures." In a descriptive account of 300 patients with diagnosed tongue thrust, Counts and Counts (1961) pictured the bony structures as being constantly responsive to the dynamic molding action of the muscles, when they are at rest and when they are performing the actions of swallowing and of speaking.

Bloomer (1963) stressed that the musculature of the face is well defined before intrauterine ossification of the face and cranium get under way. Thus, growing muscles mold bone development. As the muscles of the tongue and other parts develop habits of muscular contraction, they exert forces of pressure which determine to some extent the direction of bone growth. If the forces between the three muscle groups of mastication, facial expression, and tongue are asynchronous or otherwise unequal, disturbed growth may occur. Among detrimental neuromuscular habits which affect the oral structures, abnormal habits of swallowing have been included. Bloomer stated that whereas speech may be affected by the growth pattern of the face and jaws, habits during speaking can also play their part in influencing growth; he attributed this observation to Froeschels originally. Graber (1963, p. 448) reached similar conclusions in an analysis of the relationship of muscles to structural configuration in problems of malocclusion, pointing out that "whenever

there is a struggle between muscle and bone, bone yields." Graber further noted that muscle function, in addition to being adaptive to abnormal tooth and bone configuration, may also initiate variation in normal processes, or may enhance existing anomalies. Muscles act in a compensatory manner in an attempt to balance pattern, environment, and physiology in the performance of necessary functions. It is not always possible to assign proper value to any one role in these attempts to compensate. In partial agreement with this view, Subtelny (1965) stated that bone does have a definite ability to withstand normal as well as excessive muscle forces to a certain degree, since bone has its own inherent pattern of growth. While normally bone withstands the pressures of muscle action in swallowing, speech and mastication, "abnormal muscle action can, and does, produce bone deformity especially during growth" (Subtelny, 1965, p. 167). The problem is one of distinguishing normal from abnormal muscle activity.

Tongue thrusting

Initially, the literature on tongue thrusting consisted of clinical reports, with speculation about the significance of the behavior. When the extent of this pattern of oral activity had been recognized, and after it had come under wide suspicion as a possible factor in the stability of orthodontic tooth repositioning, it received closer attention and systematic investigation. During the same period, reports regarding the role of tongue thrusting in speech problems multiplied, although earlier

speech therapists had long suspected that there was a connection between malocclusion and faulty or defective articulation (Bloomer, 1963; Van Riper, 1963; Jann, 1960).

The course of research on tongue thrusting seems to have followed a definite sequence. Attention was first focused on establishing the activity as an identifiable syndrome of deviant behavior which accompanies malocclusion and defective speech. Some investigators (Hoffman & Hoffman, 1965; Lewis & Counihan, 1965; Bell & Hale, 1963; Ward, et al., 1966) then began to question whether tongue thrusting was actually deviant. Incidence as high as 80%-90% was considered sufficient to justify acceptance of this behavior as a normal transitional phase of development which in many cases would resolve itself as the child matured. Other studies (Mestre & Subtelny, 1964; Ricketts, Bench, Hahn, Sloan, Miethke & Ashley, 1961) indicated that tongue thrusting, while identifiable as a deviant pattern, had an ambiguous relationship to speech or to dental defects; subjects with diagnosed tongue-thrust swallow had good speech and good occlusion, while others with no observable tongue-thrust symptoms had poor speech and a poor dental situation. When hypotheses of etiology in the earlier studies had been subjected to extensive testing, the outcome was a considerable qualification of earlier conclusions.

Tongue thrusting as deviant behavior. Descriptions of tongue-thrust swallow in earlier reports (Straub, 1960; Ward, et al., 1961;

Fletcher, et al., 1961) were in general agreement with the symptom-complex later described by Subtelny (1965): during the normal swallow there is no facial grimace, the masseter muscles bring and hold the teeth and jaws together, and the tongue remains within the confines of the dentoalveolar arches; during abnormal swallowing, there is contraction of the circumoral muscles, no contact of the molars, and protrusion of the tongue between the incisors.

Among those who have supported the view that tongue thrusting is a deviant pattern, Picard (1959) referred to the initiation of the perverted swallowing habit, his designation for what later became known as the tongue-thrust swallow. Andrews (1960, p. 47) called for correction wherever possible of the atypical swallowing habit, stating that "most habit patterns are necessary for the normal growth and development of the individual, but some are deleterious . . . one is tongue thrusting." Jann (1960, p. 76) postulated, on the basis of close clinical observation, that open-bite type malocclusion and speech defects had a direct causal relationship to "perverted swallowing and tongue-thrusting habits in children." This suggests that he classified it as deviant behavior. Straub (1960), whose name is closely associated with a strong interest in the problem of tongue thrusting, reported 478 cases of "abnormal swallowing habits" from his private practice during the period 1943-57. In a later article, Straub (1962) abandoned the terms abnormal, perverted, and reverse, because of therapeutically adverse implications,

and adopted tongue-thrust swallow as a designation for the behavior. Barrett (1961, p. 727), in a discussion of his clinical observations of more than 1200 cases of "deviate" swallowing, referred to an "area of common agreement . . . few orthodontists dispute the concept that some children swallow . . . with their tongues against or between the teeth thus exerting an abnormal pressure in a vertical or labial direction." Fletcher, et al. (1961), clearly regarded tongue-thrusting behavior as a deviant pattern in a study of 1,615 subjects among whom they found 668 cases of tongue-thrust swallow. Stolzenberg (1962) called attention to adverse neuromuscular patterns of the oral cavity, referring to tongue thrusting. Palmer (1962) described the tongue-thrust swallow as a deviant pattern which included vigorous pressing of the tongue either against the teeth or through them. In the presence of this pattern, he observed that deglutition became a kind of sucking movement made possible only by tight oral closure.

Some textbooks of speech pathology began to include descriptions of tongue thrusting. In 1957, Travis (p. 639) referred to it in the following passage: "Abnormal swallowing may initiate and perpetuate the open-bite. The most noticeable defect of speech associated with open-bite is likely to be distortion of the sibilants /s/, /z/, etc." An entire manual devoted to tongue thrusting as it relates to speech correction was published by Larr (1962). Eisenson and Ogilvie (1963, p. 194) recognized

the existence of tongue thrusting as an entity in this statement: "Increasing interest is being focused on a neuromuscular syndrome commonly called tongue thrusting. The features . . . include: a deviant swallowing pattern because (1) unusual tension exists in the mouth-enclosing musculature, (2) perceptible contraction of the masseter decreases or is absent, (3) the tongue is thrust forward causing it to protrude between the teeth. As a result, the oral cavity may be changed and dental irregularities produced. Associated with these modifications are sound production defects especially of the sibilants." Van Riper (1963, p. 173) affirmed that "tongue thrusting may produce protruding teeth, open-bite, and lisp."

Tongue thrusting as normal developmental behavior. Some investigators questioned the view that tongue thrusting was deviant behavior. Among those who expressed the conviction that inconclusive evidence and the high incidence of the activity made a more qualified approach to the problem necessary, Ricketts, et al. (1961) questioned the concept of tongue thrusting as a single undifferentiated entity. Such authors classified it into normal, habitual, transitory and adaptive behavior, with overlap among the categories. They also concluded that in some cases, anatomical and structural variations may have been contributory factors. D'Asaro, Shapero, Baum and Jacoby (1961), finding an incidence of 67.3% in a study of tongue thrusting among 110 eight-to-ten-year-olds, considered that such a high figure demanded re-evaluation

of the concept of its normality. Barrett (1961) emphasized the need for rigorous research to find more explicit answers to the questions: What is a normal swallow, and how far from normal must it be before it is deviant?

Ronson (1965), critical of the methodology of many of the reports extant on the subject of tongue thrusting, stated that there was a "clear need . . . to develop more exact criteria" (p. 323). He contended that lack of uniformity of diagnostic factors and little examination of swallowing behavior in all of its varying functions were in part responsible for the inconclusiveness of diagnostic techniques. Subtelny (1965) also pointed to the sparsity of research information, stating that the present fund of knowledge was inadequate for an understanding of the tremendous variations of normal; since normality has not yet been definitively described, the concept of abnormal behavior, given usually in terms of deviations from normality, must therefore remain incomplete. He urged a critical examination of the validity of the three traditional criteria of tongue thrusting behavior: contraction of the circumoral muscles, no contact of molars, protrusion of the tongue between the incisors. The wide variation in these activities which can accompany normal occlusion with no apparent abnormality of swallowing or of speech, led him to conclude that they each need to be evaluated separately as well as in conjunction. He considered that it was an overgeneralization to require the concurrence of all three indications to make a diagnosis of tongue thrusting. Hoffman

and Hoffman (1965) also noted that in the wide variation of symptom-complexes in tongue thrusting, only some factors seemed to recur. They recommended that dentists and speech therapists make careful individual determinations of symptoms since tongue thrusting had been found to affect occlusion, or speech, or both, or neither. They suggested that it may be temporary developmental behavior, either habitual or intermittent.

Lewis and Counihan (1965) observed 294 newborn infants to discover whether tongue thrusting existed from birth; when they found that 97% swallowed with protrusion of the tongue, the question for them became, not whether tongue thrusting is normal or abnormal, but why it persisted beyond infancy as an immature pattern. They discussed the conflict between those who believe that tongue thrusting, normal in infancy, is replaced by a mature pattern after certain developmental experiences, and others who do not believe that tongue thrusting exists at birth but is the consequence of improper bottle feeding or other unfavorable condition. Hedges, McLean and Thompson (1965) supported criticism of methodology. They concurred in the view that investigations of tongue thrusting had been inconclusive, with too many variables for accuracy, leaving persistent doubts about the normal pattern of tongue activity. Suggesting that the enormous variation in this behavior lent itself to a concept of "acceptable" or "unacceptable," determined by the end results of the tongue habits, they proposed this as a more practical,

inclusive designation than normal and deviant. "The pattern of teeth-apart swallow must be an acceptable pattern . . . [since] all other associated factors were considered acceptable" (pp. 165-66). The associated factors were "excellent" occlusion, "normal" articulation, and "acceptable" skeletal and dental morphology (p. 254).

Etiology of tongue thrusting

Tongue thrusting has been ascribed to many factors beside early feeding mode; among them are neural dysfunction (Bloomer, 1963), delay in maturation of neuromuscular behavior at the cortical level (Tulley, 1956), and inheritance (Barrett, 1961). In addition, Subtelny (1965) and others have advanced as causative factors: the rapid growth of adenoidal and tonsil tissue, thumb and finger sucking, transitional stages of dentition, and developmental factors such as the disproportional size of the tongue in infancy and childhood. Since the scope of the present study is limited to the part played by the mechanics of early feeding in the etiology of tongue thrusting, only studies which examine this aspect of the problem will be reviewed.

The core of the association with early feeding seems to be the belief that a continuous, too-abundant flow of milk into the mouth of the infant interferes with breathing and swallowing reflexes, creating the necessity for an adaptive type of behavior that has an adverse influence on the development of tongue function. Meader and Muyskens (1950) noted that in suckling from the breast, the infant is completely in control of

the milk supply which must be intermittent to permit swallowing and breathing. Hoffman and Hoffman (1965, p. 115) emphasized that during the actual act of swallowing, "respiration and all oral manipulation such as licking, chewing, or sucking are inhibited and suspended." Sucking, swallowing, and breathing therefore cannot take place simultaneously; they must be sequential. It has been conjectured that the infant must protect himself from choking by some adaptive movement of the tongue to block the entrance to the throat if, during feeding, milk continues to pour into the throat as it does when a large-holed nipple is used (Larr, 1962; Straub, 1960).

Clinical observations made by Picard (1959) led him to the conclusion that nipple feeding calls forth responses entirely different from the natural milking act. Since the main mouth and facial muscular activities of the newborn infant are respiration and the intake of milk, the muscles concerned with these activities are strong and adapted to strenuous activity. An infant does not merely extract milk from the breast by the suction created by retracting the tongue, - suction plus pressure is needed. There is a strenuous stroking and squeezing action of the tongue and mandible upon the nipple. The infant must work his jaws strongly to bring milk out. Sucking from a nipple with a large hole creates the reverse situation; the infant must cope with a surplus of milk. Picard associated other adaptive movements, besides those used to block the entrance to the throat, with tongue thrusting. He asserted that "in

order to stop the abundant flow of nutrition during swallowing (from the bottle with a nipple having an excessively large hole), the infant is forced to hold the tongue forward against the hole in the nipple or drown. The perverted swallowing habit is thusly initiated" (Picard, 1959, p. 91).

Andrews (1960) also noted the difference between suckling from the breast, which needs strong upward pressures exerted by the tongue and mandible to expel milk, and sucking, which he found similar to sipping where fluids are sucked in by dropping the anterior part of the tongue. He shared Picard's conclusion that this habit pattern was associated with atypical tongue activity. Straub (1960), too, emphasized that, except in suckling at the breast, little or no vigorous tongue activity was needed to obtain a supply of milk.

Reporting clinical observations of over 1,200 cases of tongue thrusting, Barrett (1961) enumerated possible causes, among them "improper nipple feeding" which he found to lack definition. He raised the question, "Why do not all nipple-fed children manifest deviate swallowing?" (Barrett, 1961, p. 727). Ward, et al. (1961) examined 358 children in grades one through three for "visceral" swallowing. They found that 88% had not been breast fed. They speculated about the contribution of nipple feeding to the conditioning of orofacial behavior, and also about the part played by the so-called solid foods first offered to infants, usually mush that slides down. Larr (1962, p. 9), in attributing tongue thrusting directly to the practice of enlarging the hole in the nipple, stated, "When

an excessive amount of milk enters the child's mouth, he automatically thrusts his tongue against the nipple to retard the flow of milk and to prevent the escape of air out of the mouth as he swallows easy way [to bottle feed] making larger holes in the nipples leads to the forward tongue-thrust pattern." Van Riper (1963) also expressed the opinion that the abundant flow of milk caused by the widening of the nipple opening was associated with tongue thrusting.

In a survey investigating the maturation factor, Anderson (1963) related tongue thrusting to feeding mode. He found a history of bottle feeding in 92% of the tongue-thrusting subjects and in 83% of the non-tongue-thrusting subjects; 9% of the tongue-thrusters had been breast fed, and 18% of the non-tongue-thrusters had been breast fed. It was his opinion that these figures supported feeding experience as an etiological factor in this pattern. Bell and Hale (1963) reached a similar conclusion after examining 250 children for tongue-thrust swallow. Of the tongue thrusters, 69% had been bottle fed, 6% had been breast fed, and 25% had gone from breast to bottle during their first few weeks. Of those with a normal swallow, 55% had been bottle fed, 12% breast fed, and 33% had gone from breast to bottle during their first few weeks.

Feeding mode, tongue thrusting and defective articulation.

Tongue thrusting as an intervening variable. Those who share the conviction that the mode of infant feeding is a contributing factor to the etiology of tongue thrusting regard tongue-thrusting activity as one

of the intervening variables between feeding mode and defective articulation (Straub, 1960; Larr, 1962; Van Riper, 1963). Articulation is not a special faculty, but an amalgamation of several abilities. Because speech uses machinery already employed for basic vital and emotional functions, it depends on the adequacy of development of the other abilities which subserve its processes. Inadequate or faulty development of any one of these abilities may produce articulatory defects, classified as omissions (p'ay for play), substitutions (wabbit for rabbit), or distortions, the most prevalent of which are the /s/ difficulties (West, Ansberry & Carr, 1957).

Tongue thrusting, both during swallowing and during speech, may be related to defective articulation, especially of the /s/ sounds, and tongue thrusting may be related to the excessive forward posturing of the tongue in defective speakers. Fletcher, et al. (1961) found a significant relationship between tongue thrusting and sibilant distortion. Subtelny and Subtelny (1962) discovered that tongue thrusting during speech was more closely associated with defective speech than tongue thrusting during swallowing; where both exist, the potential for normal speech was viewed as unfavorable. A high incidence of tongue thrusting in lispers has been reported by Ronson (1965), Palmer (1962), and others.

Francis (1958) expressed his belief that tongue pressure could cause open bite and faulty /s/ sounds. He investigated the ten sounds articulated upon the upper teeth, which he stated accounted for 38% of all articulated sounds. When they were articulated upon the wrong surfaces,

the constant tongue pressure affected tooth position. In a later study (1960) he reiterated that the tongue pressure caused the teeth to move forward resulting in open bite which affected the production of /s/ sounds. Van Riper (1958) called attention to the possibility that malocclusion may affect articulation; when the incisors are some distance apart as in open bite and the tongue is thrust through the aperture in the teeth, the interdental lisp occurs. The situation has been summarized by Eisenson and Ogilvie (1963, p. 194): "the oral cavity may be changed, dental irregularities produced, by tongue thrusting; associated with these modifications are sound production defects especially of the sibilants."

Feeding mode and tongue development. Defective articulation has been related to the mode and amount of sucking activity. Speech requires extremely rapid shifts of muscular excitation and inhibition, especially of the tongue; and investigators have viewed sucking opportunity (and hence feeding mode) as a primary factor in the adequacy of tongue tip development. Van Riper (1958) has described the controlling musculature of the tongue as consisting of, in addition to muscles which attach it to three points in the oral cavity, intrinsic internal shaping muscles which act in intricate combinations. He emphasized the importance of sucking experience in tongue tip development; he regarded the upward and forward squeezing action of the tongue in sucking as basic to many speech sounds. Larr (1962) was in agreement that vigorous sucking action was necessary for adequate development of the lips, tongue, and jaw. Palmer (1962)

concurrent in attributing importance to feeding experience as a factor in the establishment of appropriate lingual and mandibular habits. In discussing the disparity between sucking and suckling behavior, he asserted that bottle feeding, especially with a large-holed nipple with its lessened requirement in terms of effort, was similar to drinking through a straw, in contrast to suckling from the breast which necessitates vigorous mandibular movement plus strong elevations of the tongue. He also expressed the view that the longer feeding periods needed for breast feeding further favored balanced and competent oral development.

Summary

Pertinent literature which described how differing opportunities for sucking may cause functional and structural changes in the orofacial area was summarized in Chapter II. Normative data on the prevalence of breast feeding and studies discussing various aspects of tongue-thrusting behavior were next reviewed. Acceptance of tongue thrusting as a clinical entity, its deviance, and its association with defective articulation, primarily lispings, were discussed. Material referring to the etiology of tongue thrusting, with special emphasis on the part played by early feeding mode, was then cited, and in conclusion, evidence linking feeding mode, tongue thrusting, and defective articulation was presented.

Chapter III

Procedures

The specific purpose of the present study was to compare the incidence of the factors of tongue thrusting during swallowing, tongue thrusting during speech, and defective articulation (later narrowed to one of its aspects, lisping) among children whose earliest feeding experience was under Feeding Condition 1 (enlarged hole in nipple or multiple holes or both), with the incidence of the same factors in children whose feeding history did not include this experience (Feeding Condition 0).

Pilot study

A statement by Meader and Muyskens (1950) suggested the preliminary inquiry which preceded this present research. In it, they pointed out that reflexes of the vegetative nervous system are not completely mature at birth. Their development continues during the first few weeks of life. External situations favorable to the adequate establishment of the reflexes later needed for speech are essential, especially in the way these environmental conditions affect the use of the mouth, pharynx, and breathing apparatus. They expressed the opinion that too copious a flow of milk may be one factor which interferes with organic reflexes basic to speech movements: "Few people appreciate the importance of proper feeding in infancy for speech development. The ideal method . . . is nursing the breast . . . because the flow of milk is

quantitatively such that it gives consistently uniform exercise to the sucking and swallowing muscles, whereas in bottle feeding the flow . . . is . . . determined by the varying size of the opening in the nipple" (Meader and Muyskens, p. 252). They implied that the arbitrary rate of flow thus established may interfere with the smooth development of the organic reflexes from which speech movements arise. The importance of integrating sucking, swallowing, and breathing reflexes into a steady rhythmic pattern was emphasized.

The preceding statements were inferred to mean that the development of certain reflex tongue movements is essential to some consonantal movements of the oral portion of the speech apparatus. Accordingly the pilot study was designed to explore the relation of selected oral behavior to defective articulation, in a small group of children who met the requirements later set for subjects in a subsequent study. Among the seven children in the pilot study for whom feeding condition and defective speech data were obtained, three who had been fed with enlarged-hole nipples had defective speech. Of the four children who had not been fed in this manner, two had defective speech.

Selection of subjects

Requirements for inclusion. The first step in the present study was to search for children who met the following requirements: They were hospital births, to give some control of the variables involving the effects of anaesthesia on mother and baby, the use of sterile procedures

during delivery, the uniformity of treatment of the neonate, and the aftercare of the mother which may have affected her ability to breast feed her baby. The children needed to be within the normal range in intelligence, in motor development, and in hearing. The children had to be young enough so that reasonable confidence could be placed in the mothers' recall of feeding history, yet old enough to have achieved what Myklebust (1957) has termed "expressive language." The most important requirement was that they needed to be available for study.

The history of hospital birth was obtained by questionnaires presented to the mothers. Because it was realized that three- through five-year-old children capable of participating in a group situation would meet the other requirements, and because of access to such groups, the following collections of subjects, all from Greensboro, North Carolina, were included in this study: pupils at the Nursery School in the School of Home Economics at the University of North Carolina at Greensboro; at Mrs. Scher's School for Children, a private nursery school; at Council House Day Care Center in a public housing project for low-income families; and at Parkway Baptist Church Sunday School. Children fell within the following age range: they were not younger than three years by September 1 of the year of examination, and not older than five years by September 1 of the year of examination. Eighty-two of the children were males and 77 were females.

Construction of tools for obtaining data

Questionnaire. To elicit information regarding early feeding, a questionnaire for mothers was constructed (Appendix A). Goddard, Broder, and Wenar (1961) studied the reliability of maternal recall of developmental history of children whose mean age was 4.5 years, with a range from 3.7 to 5.6 years, approximately the range in age of the subjects in this study. Recall was not completely reliable. Wenar and Coulter (1962) made a reliability study of histories obtained from mothers three to six years after original interviews. Accuracy of recall was highest in statements of fact; recall of breast and bottle feeding, which is the information required in the questionnaire constructed for this study, showed an accuracy rating of 96%. In the present survey, leading questions concerned with breast and bottle feeding were phrased indirectly and were interspersed among other inquiries to mask the true nature of the material being sought (Parten, 1950).

At the beginning of the second year of the study, a shortened and simplified form of the questionnaire was introduced and throughout the remainder of the study, this version was used.

Objective articulation device. During the first year of the study an objective articulation device, hereafter referred to as OAD, was constructed to aid in judging defective articulation. It consisted of a series of pictures of familiar objects selected after pretest with children comparable to the children in this study. The names of the objects included the consonants that the investigators wished to hear (West, Ansberry &

Carr, 1957). To guide the observers using the OAD, a detailed enumeration of possible defects in articulation was listed for each picture (Appendix B).

The construction of this tool was based upon research indicating that trained and untrained observers do not differ significantly in rating defective speech (Perrin, 1954); that both isolated words and connected speech may be used in rating articulation defectiveness (Jordan, 1960); and that repeating a word after the tester, or the spontaneous naming of objects in pictures are both accepted measures of articulation (Templin, 1947).

Modification of variables

At the end of the first year of data collection, both the tongue thrust variable and the articulation variable were modified to increase the research value of the study. Since many investigators had expressed the opinion that tongue thrusting during speech was a source of adverse tongue pressure comparable in consequences to tongue thrusting during swallowing (Subtelny & Subtelny, 1962; Bloomer, 1963; Hedges, McLean & Thompson, 1965), observations of tongue thrusting during speech were added to observations of tongue thrusting during swallowing.

The speech variable was limited to determining the presence of lisping. Eisenson and Ogilvie (1963, p. 5) stated that "three-quarters of the speech defects of children are in articulation and of this number, one-half are /s/ difficulties;" Subtelny, Mestre and Subtelny (1964, p.

269) advanced an even higher estimate, that "ninety per cent of those with articulation defects have difficulty with /s/ sounds." Therefore, lispings, a major aspect of distorted articulation, was chosen as the only item of data to define the articulation variable for the remainder of the study.

Cooperative aspects of the study

Permission for the inclusion of their children in the study was requested by letter from all parents. The letter appeared in the Bulletin of the Nursery school at the University of North Carolina at Greensboro; in the other participating groups it was presented for signature to each of the mothers (Appendix C). The mothers of the subjects in the study responded to a questionnaire covering early feeding history (Appendix A).

During the first year of the study, the OAD (objective articulation device) was used to aid in the evaluation of articulation defectiveness. To arrive at an estimate of the accuracy of the observers using this tool, interjudge agreement was calculated, using the formula (Hall, 1962, p. 95), per cent of agreement equals $\frac{2 \times (\text{N of agreements})}{\text{total for observer A} + \text{total for observer B}}$. This resulted in a figure of 85% agreement. Testing was conducted by the author assisted by various second observers including other nursery school teachers and a senior student in speech therapy.

In the second year of the study, after the articulation variable had been limited to lispings, all subjects were examined by Dr. Lawrence Vanella, Speech Pathologist and Director of the University of North Carolina at Greensboro Speech and Hearing Center, or by Miss Margaret Harry,

a graduate student in Speech Therapy and a practicing speech therapist.

During both years of the study, all examinations for the presence of tongue-thrusting behavior during swallowing were made by Dr. Raymond Tannenbaum, a practicing orthodontist in Greensboro, North Carolina.

Administration of procedures

Tongue-thrust data. The examination used in the study of tongue thrusting by Fletcher, et al. (1961, p. 203), was as follows: "To palpate muscle activity during swallowing, the examiner placed his fingers on the anterior margins of the masseter muscles . . . To negate the [labial] seal and to expose the tongue . . . the lower lip was depressed. Behavior was listed as tongue thrusting if . . . all three of the following criteria were demonstrated (a) no palpable contraction of masseter muscle . . . (b) extreme difficulty in swallowing when labial seal was abolished, (c) protrusion of the tongue beyond the edges of the incisor teeth." Ward, et al. (1961, p. 336) proceeded similarly: "During the beginning stage of the swallow the lips were parted by using the thumb and forefinger of the [examiner's] right hand to depress the lower lip. In this way it could be observed fairly easily whether or not the teeth were separated and the tongue spread between the anterior incisors during the swallow." Dr. Tannenbaum's examination for the present study paralleled the methods described in these two studies and in others, thus permitting a comparison of findings.

In the second year of the study, when tongue thrusting activity during speech had been added to the definition of the tongue-thrusting variable, the following criteria were used by the speech examiners: lingual protrusion during initiation of the swallowing act; primarily, the existence of upper incisor protrusion, and secondarily, of lower incisor protrusion; a recessive mandible; extra facial muscle activity, primarily in the area of the cheeks (Vanella, 1966).

Children were examined individually in an area removed from the group setting. Teachers introduced each child by name to the examiners, remaining with a child if reassurance was needed. Dr. Tannenbaum placed his fingers over the masseter muscles and asked each child to close his teeth and to swallow. Circumoral lip action was noted. He then depressed the child's lower lip with his thumb to observe the spread of the tongue and to estimate dental occlusion. Findings were reported to the recorder out of the child's hearing; each child was dismissed with the phrase "You're o.k!"

Articulation data. Teachers again followed the procedure of introducing each child to the judges. During the use of the OAD in the first year of the study, the two judges alternated in handing the pictures to the subjects. Findings were recorded immediately.

After the articulation variable had been limited to lisping, interdental and labiodental lisps, associated in the literature with tongue thrusting, were observed instead of generalized defective articulation. Spontaneous

speech samples were obtained while the examiner mingled with the children as they went about their routines and their play. Observations were recorded immediately on a small card concealed from the children in the examiner's hand.

Feeding condition data. Questionnaires were distributed by teachers to the mothers in each group. In a majority of cases, they were answered at once. Inability to remember the needed facts was the primary reason for not giving answers to key questions. Adoptive mothers were sometimes not in possession of the needed information about early feeding mode.

Summary

The pilot study which preceded this present research was described. The Objective Articulation Device and the questionnaire, tools constructed to aid in data collection, were also described and justified. Details of the cooperative aspects of the study were followed by details of actual data collection.

Chapter IV

Findings

The present study compares selected behavior variables in two subgroups of nursery school children. Specifically, observations were made of tongue thrusting during swallowing, tongue thrusting during speech, general defective articulation, and one aspect of defective articulation, lispings. Subgroup one consisted of subjects who had a history of having been fed with nipples with enlarged or multiple holes or both; this situation was called feeding condition one, or FC 1. Subgroup two included all subjects who had not been fed in this manner; this situation was called feeding condition zero, or FC 0.

Data consisted of information collected as follows: a questionnaire was completed by mothers of the subjects to procure information regarding feeding condition; tongue-thrusting data were obtained by direct observation of each subject by a qualified examiner; assessment of defective articulation was aided by an Objective Articulation Device (OAD) constructed according to suggestions found in speech research literature; lispings data were collected by direct observation of each subject by a speech therapist.

In the present chapter, these data will be studied for answers to the questions underlying the hypotheses in Chapter I: To what extent does feeding condition one relate to tongue thrusting during swallowing, to

tongue thrusting during speech, to defective articulation, and to lisping?

Analysis of data

Treatment of data. In applying the null hypothesis to each item of data, the following steps were taken: A frequency count for each item of behavior under each feeding condition was made using the following plan:

Behavior	Feeding condition	
	1	0
Present	a	b
Not present	c	d

Chi-square was used to test for the correlation between each variable and each feeding condition. The ϕ coefficient (Walker & Lev, 1953, pp. 272-273) ($\phi = \frac{ad - bc}{\sqrt{(a+b)(c+d)(a+c)(b+d)}}$) was computed to test the strength

of the relationship. The .05 level of confidence was adopted. From the significance of ϕ , it was determined whether the null hypothesis was rejected or retained.

Summary of data. The number of subjects examined in each year of the study for each of the variables is presented in Table 1; the results of the questionnaire about feeding condition are presented in Table 2.

Table 1

Number of Subjects Tested for each Item of Data in each Year of the Study

	Tongue thrust (swallow)	Tongue thrust (speech)	Defective articulation	Lisping
First year	68	0	68	0
Second year	91	91	0	91
Total	159	91	68	91

Table 2

Number and Per Cent of Subjects in Each of the Feeding Conditions

Feeding Condition	Number	Per Cent
FC 1	103	64.2
FC 0	56	35.8
Total	159	100.

Tongue-thrusting data. In Table 3, the data referring to the correlation of tongue thrusting during swallowing and FC 1 (that is, with nipples with enlarged or multiple holes or both) are presented.

Table 3

Tongue Thrusting during Swallowing under Each Feeding Condition (N = 159)*

	FC 1		FC 0		Total	
	N	%	N	%	N	%
Tongue thrusting during swallow	39	37.8	16	28.5	55	34.5
No tongue thrust during swallow	64	62.2	40	71.5	104	65.5
Total	103	100.	56	100.	159	100.

*Includes entire population for both years of the study.

Chi-square was 1.272 which is not significant at the .05 level of confidence. Since these data produced no evidence that there is a difference in the frequency of tongue thrusting between subjects who had been fed under feeding condition one and those who had not been fed in this manner, the null hypothesis was accepted.

Data referring to the correlation of tongue thrusting during speech and the two feeding conditions is presented in Table 4.

Table 4

Tongue Thrusting during Speech under Each Feeding Condition (N = 91)*

	<u>FC 1</u>		<u>FC 0</u>		<u>Total</u>	
	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>
Tongue thrusting during speech	27	41.5	9	34.6	36	39.6
No tongue thrust during speech	38	58.5	17	65.4	55	60.4
Total	65	100.	26	100.	91	100.

*Includes population for the 2nd year of study only.

Chi-square was .273, which is not significant at the .05 level of confidence. On the basis of these data, no significant difference was found in the incidence of tongue thrusting during speech between subjects fed with nipples with enlarged or multiple holes and those not fed in this manner. The null hypothesis was accepted.

Articulation data. In Table 5, the data referring to the correlation of defective articulation, and the two feeding conditions, are presented.

*Includes population for the second year of the study only.

Table 5

Defective Articulation under Each
Feeding Condition (N = 68)*

	FC 1		FC 0		Total	
	N	%	N	%	N	%
Defective articulation	21	55.3	16	53.4	37	54.5
No defective articulation	17	44.7	14	46.6	31	45.5
Total	38	100.	30	100.	68	100.

*Includes population for the 1st year of the study only.

Chi-square was .025, which is not significant at the .05 level of confidence. From these data, it cannot be said that a difference in amount of defective articulation exists between subjects who were fed with nipples with enlarged or multiple holes, and those who were not. Therefore, the null hypothesis was accepted.

In Table 6, the data referring to the correlation of lisping and the two feeding conditions is presented.

Table 6

Lisping under Each Feeding Condition
(N = 91)*

	FC 1		FC 0		Total	
	N	%	N	%	N	%
Lisping	33	50.7	11	42.3	44	48.3
No lisping	32	49.3	15	57.7	47	51.6
Total	65	100.	26	100.	91	100.

*Includes population for the second year of the study only.

Chi-square was .525, which is not significant at the .05 level of confidence. No evidence having been produced to show that lispng behavior differs when subjects were fed with nipples with enlarged or multiple holes as contrasted to any other manner, the null hypothesis was accepted.

Discussion of findings

The present study may be summarized by the question: Has it been shown that FC 1, the enlargement or provision of multiple holes in nipples during feeding in infancy, was a specific factor in the modification of patterns of tongue development, and/or later of articulation, in the group of 159 children who were the subjects of this survey? No significant differences were found between children under FC 1 and FC 0. Therefore, the results do not support the contention that such symptoms follow one or another feeding style. This does not mean that feeding condition may not have been a factor in tongue and articulation development, but suggests, on the basis of the data collected in the present survey, that the variables of tongue thrusting during swallow, tongue thrusting during speech, defective articulation, and lispng, are not related to the infant feeding style investigated.

Other feeding mode reports. A minimum duration of one month was arbitrarily chosen as a criterion for breast feeding for this survey; 18.8% of the subjects had been breast-fed. These children were classified under feeding condition zero unless they had been weaned to a nipple

with an enlarged hole, in which cases they were classified under feeding condition one. In the national surveys made by Bain in 1948 and by Meyer in 1956, the criterion to indicate breast feeding was its employment as feeding mode at the time of the mother's departure from hospital.

Although Meader and Muyskens (1950), Picard (1950), Palmer (1962), Straub (1960), Larr (1962), and Van Riper (1963) have all asserted that the specific variable studied in the present report, the use of nipples with enlarged or multiple holes or both, was a determinant of orofacial and articulation behavior, no investigation limited to this one aspect of nipple feeding was found in the literature. In other reports linking feeding mode to tongue and to articulation development, no discrimination was made between the various methods of nipple feeding (which in every instance was regarded as a single all-inclusive variable). Because the nipple-feeding factor in this study was not identical to the nipple-feeding factor in other studies, comparison of findings can only be suggestive.

Age of subjects. Other research in this area has used school-age children as the source of data (Bell & Hale, 1963; Fletcher, et al., 1961; Hoffman & Hoffman, 1965; Subtelny, et al., 1964; Ward, et al., 1961). The choice of pre-school children for this survey was not made by chance. This age group was selected because it was hoped that the younger the children, the more accurate would be the mothers' recall

of early feeding history. Also, Subtelny (1964), Ward, et al. (1961) and others have stressed the need for extending observations of tongue thrusting in both directions chronologically - down to the preschool ages and up to adolescence and adulthood.

From the point of view of speech competence, the choice of three- and four-year-old children can be defended. Although slowness of muscular movement may cause defective articulation, and muscular speed is idiosyncratic, the rate at which reciprocating impulses can be shifted from a given group of muscles to its antagonistic group and back again (diadochocinesis), increases with age. (West, Ansberry & Carr, 1957). The majority of children at this age may thus be at the same general level of incompetence in articulation, and the argument may be made that any group of nursery-age children will show a large proportion of lisping and other defective articulation regardless of how they were fed, since the final acquisition of /s/ sound production may not occur until six to eight years of age or even later (Eisenson & Oglivie, 1963; Van Riper, 1958). The finding that nearly one-half of the children in the present survey were without the articulation defects considered crucial for the study (45.5% did not have generally defective articulation, and 51.6% did not lisp) can be interpreted to mean that the age group which was chosen is at the dividing point where incompetency in articulation is giving way to adequate speech.

A search of the literature revealed no study of speech in preschool

children with which comparisons of findings, with respect to age factor, could be made.

Summary

A restatement of the specific purpose of the study was followed by a restatement of the procedures of data collection. The steps taken in applying the null hypothesis to each item of data were described. Tables presented the data applying to each variable under each feeding condition. The results of statistical treatment showed that in every case the null hypothesis could not be rejected.

Discussion centered upon the impossibility of making comparisons with other studies in the literature because variables investigated were not identical.

Chapter V

Summary: conclusions: suggested research

The goal of the present study was to investigate the possibility that four behaviors denoting deviance in oral and articulatory development (tongue thrusting during swallowing, tongue thrusting during speech, general defective articulation, and lispings) may be related to an extent not yet fully explored to the way in which an infant has been fed. Hypotheses were formed predicting that there would be no difference in the incidence of each of the four behavior variables between children who had been fed with enlarged or multiple holes in nipples, and children who had not been fed in this manner. The findings of the study produced no evidence for rejection of any of the hypotheses.

Conclusions

Larr (1962), Meader and Muyskens (1950), Palmer (1962), Picard (1959), Straub (1962), and Van Riper (1963) have claimed that the use of nipples with enlarged or multiple holes has specific consequences for oral and articulatory development. The null hypotheses of this study were accepted; it follows that the only conclusion that may be drawn is that unless and until evidence from further research can be produced to substantiate such claims, they remain speculative and should be received with caution.

Suggestions for further research

The serious concern expressed by both orthodontists and speech therapists about the extent to which tongue thrusting may be responsible in the relapse of corrected occlusion and in the production of defective speech warrants a full-scale search for preventive measures. In the reports associating tongue thrusting, malocclusion, and defective speech with artificial feeding in infancy, the contribution of early feeding mode to the problem remains obscure. Because the circumstances of feeding in early infancy are often forgotten three to five years after the events, such information must be obtained as early as possible. It is therefore recommended that routine inquiries about early feeding be included in initial interviews with parents by nursery school personnel, pediatricians, pedodontists, orthodontists, and speech therapists. Specially redesigned nipples which attempt a closer approximation of the physiological sequence and mechanics of suckling from the human breast are currently available (Nuk Zauger nipples and Edwall Nursing Nipples). Records and follow-up studies of the users of these appliances should provide an exceptional opportunity for information bearing upon the relation of tongue thrusting to feeding mode.

Tongue thrusting and defects in speech are evolving situations which change with growth and maturation, processes which can only be evaluated by longitudinal, periodic examinations of the same subjects at successive stages of development (Hoffman & Hoffman, 1965). For greater clarification of the link between feeding mode, tongue thrusting,

and defective articulation, cross-sectional studies such as the present survey need to be supplemented by follow-up and longitudinal material. Infant day care such as the University of North Carolina at Greensboro Demonstration Nursery Center offers an unusual opportunity for obtaining information verifiable by direct observation of all the situations described in the present study: feeding mode, emerging dentition, patterns of tongue activity, and developing speech. It is suggested that a systematic long-term study of these processes be considered one of the research possibilities of this and other similar facilities.

A pooling of information and technical knowledge between orthodontists and speech therapists has been widely recommended (Barrett, 1961; Bloomer, 1963; Hoffman & Hoffman, 1965; Jann, 1960). Since members of these two specialties encounter populations already presenting symptoms of pathology, and since general pediatric practice includes the normal as well as tongue-thrusting and speech defective populations, it is suggested that as a source of obtaining control subjects, a pediatrician be a part of any collaborative effort.

Almost without exception, the authors of the many theories and conjectures about causative factors in tongue thrusting and defective articulation cite a lack of clear-cut evidence about one or another aspect of the problem. The following questions selected from orthodontic and speech pathology literature indicate the wide range of topics where definitive research has yet to be done:

What actually constitutes the tongue thrusting syndrome? Agreement needs to be reached upon a definition of symptomology before comparisons may be made among studies (Bloomer, 1963; D'Asaro, et al., 1961; Lewis & Counihan, 1965; Ricketts, et al., 1961; Ronson, 1965).

What proportion of tongue thrusting is transient behavior; at what age does spontaneous resolution begin; if persistence is abnormal, what causes it? (Fletcher, et al., 1961; Gellin, 1966; Graber, 1963; Hoffman & Hoffman, 1965; Ricketts, et al., 1961; Ward, et al., 1961).

Is there a link between low motor ability, or neural dysfunction, and weak sucking, tongue thrusting, and defective speech? (Dickson, 1962; Harrington, 1962; Prins, 1962; Bloomer, 1963).

What is the incidence of tongue thrusting in other cultures where there is little or no artificial feeding of infants and where breast feeding may be continued long past infancy? (Palmer, 1962; Ward, et al., 1961).

If enlargement of the nipple hole is a procedure routinely advised by all pediatricians, why do some mothers accept the suggestion and others do not? (Present investigator).

REFERENCES

Andrews, W. S. Relation of tongue thrusting to speech development and other factors. *Amer. J. Orthodont.*, 1940, 26, 100-106.

Andrews, W. S. Tongue thrusting. *J. Clin. Orthodont.*, 1947, 11, 47-51.

Bain, K. The incidence of breast feeding in Scotland. *Br. J. Orthodont.*, 1948, 2, 112-115.

Barrett, M. H. One approach to speech development. *Am. J. Orthodont.*, 1961, 47, 766-768.

Coll, Dorothy, & Hale, Anne. The effect of tongue thrusting on speech in preschool children. *J. Clin. Orthodont.*, 1962, 26, 115-119.

Ellis, H. H., & Ellis, J. H. The nursing effect on the development of tongue thrusting, short nursing on the retention of the tongue thrust. *J. Orthodont. Soc. Persh.*, 1958, 25, 113-120.

Ellinger, M. H. Speech defects in relation to a baby's feeding. *Am. J. Orthodont.*, 1963, 49, 520-527.

Frankenridge, Martin E., & Murphy, Mrs. M. P. *Speech and orthodontics: a study of the young child*. W. B. Saunders Company, Philadelphia and London, 1957.

Green, A. G., 1962, p. 117, in *Orthodontics*. Green, A. G., & Hodges, R. L. Tongue thrust and deglutition: some anatomical, physiological,

References

- Anderson, W. S. Relation of tongue-thrust syndrome to maturation and other factors. Amer. J. Orthodont., 1963, 49, 264-275.
- Andrews, R. G. Tongue thrusting. J. S. Calif. State Dent. Assoc., 1960, 28, 47-53.
- Bain, K. The incidence of breast feeding in hospital in the U. S. Pediatrics, 1948, 2, 313-319.
- Barrett, R. H. One approach to deviate swallowing. Amer. J. Orthodont., 1961, 47, 726-736.
- Bell, Dorothy, & Hale, Anita. Observation of tongue-thrust swallow in preschool children. J. of Sp. and Hearing Dis., 1963, 28, 195-197.
- Blau, T. H., & Blau, L. B. The sucking reflex: the effects of long feeding vs. short feeding on the behavior of the human infant. J. abnormal soc. Psych., 1955, 51, 123-125.
- Bloomer, H. H. Speech defects in relation to orthodontics. Amer. J. Orthodont., 1963, 49, 920-929.
- Breckenridge, Marian E., & Murphy, Margaret N. Growth and development of the young child. W. B. Saunders Company, Philadelphia and London, 1963.
- Brodie, A. G., 1962, p. 117, in Hoffman, Jeanette H., & Hoffman, R. L. Tongue-thrust and deglutition: Some anatomical, physiological,

- and neurological considerations. J. of Sp. and Hearing Dis., 1965, 30, 105-121.
- Caldwell, Bettye M. The effects of infant care. In M. L. Hoffman & L. W. Hoffman (Eds.), Review of child development research. New York: Russell Sage Foundation, 1964. Pp. 9-88.
- Counts, A. B., & Counts, C. R. A clinically-derived picture of 300 individuals with tongue thrusting. Asha Journal, 1961, 3, 369.
- D'Asaro, M. J., Shapero, S. O., Baum, A. T., & Jacoby, M. N. Tongue thrusting: orthodontic and speech problem. Asha Journal, 1961, 3, 369.
- Davis, H. V., Sears, R. R., Miller, H. C., & Brodbeck, A. J. Effects of cup, bottle, and breast feeding on oral activities of newborn infants. Pediatrics, 1948, 2, 549-558.
- Dickson, S. Differences between children who spontaneously outgrow and children who retain functional articulation errors. J. of Sp. and Hearing Res., 1962, 5, 263-271.
- Eisenson, J., & Ogilvie, M. Speech correction in the schools. (2nd ed.) New York: Macmillan Co., 1963. P. 194.
- Erikson, E. H. Childhood and society. W. W. Norton & Company, Inc., New York, 1950.
- Fletcher, S. G., Casteel, R. L., & Bradley, D. P. Tongue-thrust swallow, speech articulation, and age. J. of Sp. and Hearing Dis., 1961, 26, 20-208.

- Fredeen, R. C. Cup feeding of newborn infants. Pediatrics, 1948, 2, 544-548.
- Francis, T. R. A preliminary note on tongue thrusting and associated speech defects. Speech Pathol. & Ther., 1958, 1, 70-72.
- Francis, T. R. The articulation of English speech sounds. Speech Pathol. & Ther., 1960, 3, 18-26.
- Goddard, K. E., Broder, G., & Wenar, C. Reliability of pediatric histories. A preliminary study. Pediatrics, 1961, 28, 1011-1018.
- Graber, T. The "three M's": Muscles, malformation, and malocclusion. Amer. J. Orthodont., 1963, 49, 418-450.
- Hall, Olive A. Research handbook for home economics education. Minneapolis: Burgess Pub. Co., 1962.
- Hedges, R. B., McLean, C. D., & Thompson, F. A. The cinefluorographic study of tongue patterns in function. Angle Orthodontist, 1965, 35, 253-268.
- Hoffman, Jeanette H., & Hoffman, R. L. Tongue thrust and deglutition: Some anatomical, physiological, and neurological considerations. J. of Sp. and Hearing Dis., 1965, 30, 105-121.
- Irwin, J. Psychological implications of voice and articulation disturbances. In Barbara, D. A. Psychological and psychiatric aspects of speech and hearing. Springfield, Ill., Charles C. Thomas, 1960. Pp. 288-320.
- Jann, H. W. Tongue thrusting as a frequent unrecognized cause of

- malocclusion and speech defects. N. Y. State Dent. J., 1960, 26, 72-81.
- Jordan, E. P., Articulation test measures and listener ratings of articulation defectiveness. J. of Sp. and Hearing Res., 1960, 3, 303-318.
- Larr, A. L. Tongue thrust and speech correction. San Francisco: Fearon Publishers, Inc., 1962.
- Lewis, J. A., & Counihan, R. F. Tongue thrusting in infancy. J. of Sp. and Hearing Dis., 1965, 30, 280-282.
- Matthews, J. Speech Defects. In C. M. Louttit (Ed.), Clinical psychology of exceptional children. (3rd ed.) New York: Harper, 1957. Pp. 391-424.
- McClearn, G. E. Genetics and behavior development. In M. L. Hoffman & L. W. Hoffman (Eds.), Review of child development research. Vol. 1. New York: Russell Sage Foundation, 1964. Pp. 433-480.
- Meador, C. L., & Muyskens, J. H. Handbook of biolinguistics. Part one - section A. Toledo, Ohio: Herbert C. Weller, 1950.
- Meyer, J. F. Breast feeding in the U. S. Extent and possible trend. Pediatrics, 1958, 22, 116-121.
- Myklebust, J. R. Aphasia in children - language development and language pathology. In Travis, L. C. Handbook of speech pathology. New York: Appleton-Century-Crofts, Inc., 1957. Pp. 503-513.

Palmer, J. M. Tongue thrust: a clinical hypothesis. J. Sp. and Hearing Dis., 1962, 27, 323-333.

Parten, Mildred B. Surveys, polls, and samples; practical procedures. New York: Harper, 1950.

Perrin, E. H. The rating of defective speech by trained and untrained observers. J. Sp. and Hearing Dis., 1954, 19, 48-51.

Picard, P. J. Bottle feeding as preventive orthodontics. J. Calif. Dent. Assoc., & Nevada Dent. Soc., 1959, 35, 90-95.

Prins, T. D. Motor and auditory abilities of children with articulatory deviations. J. of Sp. and Hearing Res., 1962, 5, 161-168.

Ricketts, R. M., Bench, R. W., Hahn, Elise, Sloan, R. F., Miethke, J., & Ashley, F. L. Tongue thrusting, orthodontic and speech presentation. Asha Journal, 1961, 3, 369.

Ronson, I. Incidence of visceral swallow among lispers. J. of Sp. and Hearing Dis., 1965, 30, 318-324.

Salber, Eva J., Stitt, P. G., & Babbott, J. G. Patterns of breast feeding. New Eng. J. Med., 1958, 259, 707-713.

Salber, Eva J., & Feinleib, M. Breast feeding in Boston. Pediatrics, 1966, 37, 299-303.

Sears, R. R., & Wise, G. W. Relation of cup-feeding in infancy to thumb-sucking and oral drive. Amer. J. Orthopsychiatry, 1950, 20, 123-138.

Stolzenberg, J. Controlled suggestion in speech problems and tongue thrust.

- Amer. J. Orthodont., 1962, 48, 604-608.
- Straub, W. J. Malfunction of the tongue. Amer. J. Orthodont., 1960, 46, 404-424.
- Straub, W. J. Malfunction of the tongue. Amer. J. Orthodont., 1962, 48, 486-503.
- Subtelny, J. D. Examination of current philosophies associated with tongue-thrust behavior. Amer. J. Orthodont., 1965, 51, 161-182.
- Subtelny, Joanne D., Mestre, J. C., & Subtelny, J. D. Comparative study of normal and defective articulation of /s/ as related to malocclusion and deglutition. J. of Sp. and Hearing Dis., 1964, 29, 269-285.
- Subtelny, J. D., & Subtelny, Joanne D. Malocclusion, speech, and deglutition. Amer. J. Orthodont., 1962, 48, 685-697.
- Templin, M. C. Spontaneous vs. imitated vocalization in testing articulation in preschool children. J. of Sp. and Hearing Dis., 1947, 12, 293-300.
- Travis, L. C. Handbook of speech pathology. New York: Appleton-Century-Crofts, Inc., 1957.
- Tulley, W. J. Adverse muscle forces - their diagnostic significance. Amer. J. of Orthodont., 1956, 42, 801-813.
- Vanella, L. Personal communication, 1966.
- Van Riper, C. Speech correction. Englewood Cliffs, New Jersey:

Prentice-Hall, 1963.

Van Riper, C., & Irwin, J. V. Voice and articulation. Englewood Cliffs, New Jersey: Prentice-Hall, 1958.

Walker, J. M., & Lev, J. Statistical inference. New York: Henry Holt and Company, 1953.

Ward, Marion M., Malone, Sister Helen D., Jann, Gladys R., & Jann, J. W. Articulation variations associated with visceral swallowing and malocclusion. J. of Sp. and Hearing Dis., 1961, 26, 334-343.

Wenar, C., & Coulter, J. B. A reliability study of developmental histories. Child Develpm., 1962, 33, 453-462.

West, R., Ansberry, Merle, & Carr, Anna. The rehabilitation of speech. (3rd ed.) New York: Harper & Brothers, 1957.

Winitz, H. Research in articulation and intelligence. Child Develpm., 1964, 35, 287-297.

Yarrow, L. J. Separation from parents during early childhood. In M. L. Hoffman & L. W. Hoffman (Eds.) Review of child development research. New York: Russell Sage Fund, 1964, Pp. 89-136.

APPENDIX A

Questionnaires for Early Feeding Information from Mothers

1. Was your baby close to term? Premature? Late?
Caesarean? Did you have rooming-in?
2. Had you expected to breast-feed? When first put to the breast,
did your baby take the nipple vigorously? Did you need to coax?
How long was there breast feeding only? Were all feed-
ings from the first given by bottle?
3. Was the baby a fast feeder? Slow feeder? Did you find
that you had to make a bigger hole in the nipples? Did the baby
ever choke from too rapid flow of milk? Did it ever run from
the corners of the baby's mouth?
4. If breast fed, was the night feeding given in the hospital nursery?
Were any other supplementary bottles given in the hospital?
Were supplementary bottles given at home? How long was the
baby on the breast and bottle both?
5. When was the cup first offered?

Solid food first offered in a spoon?
6. If you are right handed, did you usually hold your baby in your left
arm, and the bottle in your right hand? The reverse?
7. Was this a good baby who slept all night? Were there any per-
iods of incessant crying during the first two months? If so,
was it colic? Trouble with formula? Ear trouble?
Other?
8. Was there much crying from hunger before feedings? Were
feedings scheduled? Self-demand?
9. Which feedings were given with the bottle propped by a pillow or
bottle-holder, daytime or night-time?
10. At what age in months was the absolutely final bottle given?
Were there many attempts at weaning before success?
11. What methods were used to discourage thumbsucking?

Successful?

At what age was it abandoned?

DIRECTIONS

It is very important to the success of this study to try to remember as clearly as you can, so please take your time and check every question.

No one else will see these answers except me. You will be given a report on your child when the study is finished. I thank you for your cooperation.

Julia Richman.

Was this baby premature? _____ Born in which hospital? _____

	Yes	No	Don't know
<u>DID YOUR BABY</u> ---			
have to be coaxed at first to suck? _____			
suck very slowly? _____			
suck so fast that he sometimes choked? _____			
suck so fast that milk sometimes ran out of the corners of his mouth? _____			
get bottles in the hospital even if breast-fed? _____			
cry a lot before feedings? _____			
<u>DID YOU EVER</u> ---			
have to make a bigger hole in the nipple to help your baby get the milk? _____			
or have to make two or three extra holes in the nipple? _____			
use a bottle holder? _____			

71.

AT ABOUT WHAT AGE DID YOUR BABY ---	Days	Weeks	Months	Don't know
go from breast to bottle? _____				
go from breast to cup? _____				
go from bottle to cup? _____				
start to eat from a spoon? _____				
start thumbsucking? _____				
stop thumbsucking? _____				

Objective Articulation Device

Directions to students

This is a simple screening test for students in articulation. The purpose is not to diagnose the kind or extent of error, but to determine whether errors exist. Listen for examples of: substitution of sounds, omissions of sounds, insertion of sounds, and the use of disordered, listed in the chart; all hearing is distortion.

- | | |
|-----------------|------------------|
| Picture | Listen for: |
| 1. Tip of bread | bread, bread |
| 2. Tail of soap | soap, soap, soap |

APPENDIX B

Objective Articulation Device

- | | |
|---|--|
| 3. Twelve candles burning | twelve, twelve |
| 4. Turnout | turnout, turnout |
| 5. Grains of wheat | grain, grain |
| 6. A cup of coffee and a box of crackers | top, top, coffee, coffee, crackers, crackers, crackers |
| 7. A shoe | shoe, shoe |
| 8. A potato | potato, potato |
| 9. Jelly-beans | jamie, jamie, jamie, jelly-beans, jelly-beans |
| 10. A bunch of grapes | grapes, grapes, grapes, grapes, grapes |
| 11. Socks | socks, socks, socks |
| 12. No picture, just a page of yellow paper | Lellow, wellow, yellow, wellow |

Objective Articulation Device

Directions to assistant

This is a simple screening test for errors in articulation. The purpose is not to diagnose the kind or extent of error but to determine whether errors exist. Listen for examples of: substitution of sounds, wabbit for rabbit; omission of sounds, ca' for cat; or distortions, tsurch for church; all lispings are distortions.

Picture	Listen for:
1. Slice of bread	bwead, b'ead
2. Bowl of soup	thoup, shoup, toup
3. Twelve candles burning	tannels(th), tannows(th)
4. Spaghetti	thpagetti, pathgetti, pizgetti
5. Cooked bacon	baton, graken
6. A cup of coffee and a box of crackers	tup, tuh, toffee, tohee, cwackers, ca'ers, twa'ers(th)
7. A shoe	soo, thoo
8. A tomato	pahmatah, kamato
9. Jelly-beans	tannie, kannie, kennie, dzelly-beans, jewwy-beans
10. A bunch of grapes	dapes(th), d'a'ce(th), dwapes(th) gwapes(th), g'ates(th)
11. Roses	woses, wothesth, woshesh
12. No picture, just a page of yellow paper	Lellow, wellow, jellow, wewwo

Letter to Parents

Dear Parents:

I am a graduate student in Child Development at the University of North Carolina at Greensboro, doing research about the early feeding habits of children. I am asking permission to include your child in the study.

During the regular school session, each child will be asked to sit on my assistant's watch and watch how his teeth come together when he swallows. Each child will be asked to eat some of several favorite foods. Altogether, this will take only about one minute of time.

Letter to Parents

Mothers will be asked to write answers to some questions about the child's early feeding habits. This may be done at school and will take about five minutes.

Your cooperation will be appreciated.

Sincerely,

Jule K. Johnson

Letter to Parents

Dear Parents:

I am a graduate student in Child Development at the University of North Carolina at Greensboro, doing research about the early feeding habits of children. I am asking permission to include your child in the study.

During the regular school session, each child will be asked to let me and my assistant watch how his teeth come together when he swallows. Each child will also be asked to name several favorite foods. Altogether, this will take only about one minute of time.

Mothers will be asked to write answers to some questions about the child's early feeding habits. This may be done at school and will take about five minutes.

Your cooperation will be appreciated.

Sincerely,

Julia Richman