Tongue Thrusting and Interdentalization of Speech Sounds among Cleft Palate and Noncleft Palate Subjects

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Numerous reports have been published concerning the deviant swallowing pattern commonly known as tongue-thrust (*13, 15, 18, 19, 24, 25*). These reports have generally used normal speakers and/or articulation-defective speakers as subjects. There appears to be no investigations of the swallowing patterns of persons with cleft palates.

It would appear likely that an infant with an unrepaired cleft, particularly a cleft involving the alveolar ridge and/or the hard palate, would be unable to obtain the necessary pressure on the palate to accomplish a normal swallow. In addition, the etiology of tongue thrusting has often been related to bottle feeding (*13, 15, 18, 19, 24, 25*). Cleft palate children are frequently bottle fed and some of the techniques used in feeding these children would seem to allow little practice in developing strong suckle-swallow patterns.

Initially, tongue thrusting was brought to the attention of the orthodontist who found that such abnormal swallowing habits caused many dental anomalies. The speech clinician became aware of such abnormal swallowing patterns, however, as possible reasons for speech disorders. Whitman and Jann (*25*) recognized tongue thrusting as a cause of "... either frontal or lateral lisping of sibilant sounds and dentalizing, interdentalizing or distortions of lingual-alveolar sounds."

Several authors (*1–3, 5–9, 11, 12, 20, 21, 23, 24*) have indicated that individuals with cleft palate demonstrate compensatory tongue movements, which probably are due to the lack of normal oral structures. Such compensations are probably habits established before palatal surgery which remain even after surgery has provided the speaker with a normal mechanism. It is important, therefore, for the speech clinician to recognize any compensations or deviations and to help the person with cleft palate to use his speech mechanism most effectively.

In recent years research has provided descriptive studies of the articulation disorders shown by cleft palate children and adults (*4, 10, 17*).

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The stop-plosives /t/ and /d/, the nasal /n/, and the lateral-lingua-alveolar /l/ were not found to be among the most frequently misarticulated sounds, probably because most investigators made evaluations of articulatory errors on such sounds by using the auditory stimulus alone, and did not consider the focal articulation point placement as a criterion for judging articulation errors. Those who do mention considering focal articulation point placement are not specific as to the type of error.

My clinical observations of cleft palate speakers lead me to believe that the lingua-alveolar sounds are visually misarticulated enough that the speech clinician should be concerned. Therefore, the present study is concerned with the focal articulation placement for the lingua-alveolar sounds /t/, /d/, /n/, and /l/ (that is, with the visual aspects of these sounds rather than their acoustic aspects).

Purpose

This investigation was concerned with two assumptions: a) that more cleft palate subjects have faulty tongue movements (tongue thrusting) during the act of swallowing than do noncleft palate subjects, and b) that more subjects with cleft palate tend to protrude the tongue-tip beyond the edge of the incisor teeth (interdentalizing) when producing the speech sounds /t/, /d/, /n/, and /l/ than do noncleft palate subjects.

Procedure

SUBJECTS. The total sample was comprized of 44 cleft lip and/or palate subjects and 44 noncleft palate subjects. There were 23 males and 21 females in each of these groups. The types of clefts represented in the experimental group are shown in Table 1. Although I recognize that the severity of the structural problem may affect tongue placement for swal-

TABLE 1. Number of cleft palate subjects, by type (Veau), by age group, and by sex. Subjects in group I ranged in age from 3 to 9 years; subjects in group II ranged in age from 10 to 20 years.

type of cleft (Veau)	*group I (younger)*		*subtotal*	*group II (older)*		*subtotal*	*total*
	male	*female*		*male*	*female*		
I	4	2	6	0	0	0	6
II	1	2	3	2	2	4	7
III	5	5	10	4	7	11	21
IV	4	0	4	1	1	2	6
lip-alveolar	0	2	2	2	0	2	4
			—			—	—
totals			25			19	44

lowing or speaking, no comparisons will be made between the types of cleft palate in this paper.

The noncleft palate subjects were matched in age within two months of the cleft palate subjects. The age range was 3 years and 10 months to 20 years and 11 months, with a mean age of 10 years (SD 4 years 10 months). Each group was divided into two age groups designated as age-group I (3 years 10 months to 9 years 11 months) and age group II (10 years to 20 years 11 months). Poole (*14*) and Templin (*22*) have shown that normal children approximate adult articulation by 8 years of age. A division at 10 years for the two age-groups was chosen because I felt that a two year extension of Poole's and Templin's findings would certainly eliminate maturation as a causative factor for articulation errors in the older age-group.

Fifty-one cleft palate subjects were tested; of this number, seven were eliminated because of hearing loss or because of a concern that speech therapy may have corrected interdentalizing.

The cleft palate subjects were gathered from community and hospital speech clinics, public school speech therapy classes, orthodontic clinics, and from the practices of plastic surgeons. The noncleft palate subjects were chosen at random from public school classrooms; many noncleft palate subjects were in the same classrooms as the cleft palate subjects with which they were matched.

Subjects who had auditory thresholds greater than 20 dB (ASA) at any one of the five frequencies (500, 1000, 2000, 4000, and 6000 Hz), measured in either ear were excluded from this study (*16*).

Evaluating Interdentalization. An evaluation of tongue-tip placement for the phonemes /t/, /d/, /n/, and /l/ was made by having the subject repeat single words containing the four test sounds in the initial, medial, and final positions. Only one word was used for each sound in each position, but an alternate word was available for a repeat evaluation if there was some question about the subject's tongue placement. The subject was placed so that he would not receive visual cues from the stimulus production of the test words.

Evaluating Tongue Thrusting. Tongue-tip positioning during the act of swallowing was determined by the following criteria. a) The subject's pursing of the lips and position of the tongue between the teeth were noted while at rest or at least not being tested. b) The subject was asked to swallow and to report where the pressure of the tongue was and whether the back teeth were together or apart. c) The subject was asked to swallow as the examiner pulled down the lower lip with her thumb to observe the motion of the tongue. The subject then swallowed again while the examiner placed her finger tips on the temporal mandibular area in an attempt to evaluate closure of the teeth. In procedures two and three swallowing was observed, if at all possible, with saliva in the mouth. On occasion, it was necessary to give the subject a small amount of water to facilitate swallowing.

The swallow was evaluated as either normal or characterized by one of three types of tongue thrust, defined as follows. a) *Mild:* the tongue was inconsistently found between the teeth on repeated swallows when the lower lip was pulled down by the examiner, yet there was no observable pressure against the teeth and no pursing of the lips. Generally, the subject's report of tongue position and approximation of the teeth was inconsistent with my observation. b) *Moderate:* a thrust of the tongue between the anterior teeth during swallow was observed; however, the pressure, evaluated subjectively by me, was moderate. The back teeth were separated. There was little or no pursing of the lips. The subjects reported forward pressure of the tongue, although with repeated trials they were sometimes inconsistent in their reports. c) *Severe:* a forward motion of the tongue during swallow, pursing of the lips, and separation of the back teeth were all observed. There was a consistent report from the subject of forward tongue pressure and of separation of the back teeth.

While 17 of the 44 cleft palate subjects were being tested, one of eight other speech clinicians was present. Each made independent evaluations of the subject's performance. In all instances, there was agreement as to whether or not the subject interdentalized the test sounds and/or demonstrated tongue thrust patterns of swallowing.

Results

In this study the standard error of the difference between independent proportions was employed, with the level of significance set at 1%.

The results showed that more cleft palate subjects than noncleft palate subjects showed tongue thrust patterns during the act of swallowing and interdentalization during speech.

TONGUE THRUSTING. Eighteen percent of the noncleft palate subjects and 38.5% of the cleft palate subjects demonstrated tongue thrust, mild, moderate or severe. Disregarding the mild category, 4.5% of the noncleft palate subjects and 34% of the cleft palate subjects showed tongue thrust.

In age group I (3 to 11-year-olds), 40% of the cleft palate subjects and 32% of the noncleft palate subjects showed tongue thrust. Excluding the mild category in this younger age group, 36% of the cleft palate subjects and 8% of the noncleft palate subjects showed tongue thrust. In age group II (10 to 21-year-olds), no noncleft palate subject and 36% of the cleft palate subjects demonstrated tongue thrust. Disregarding the mild category, 31% of the cleft palate subjects demonstrated the problem. To summarize, the cleft palate subjects tongue thrusted more than the noncleft palate subjects in both age groups when the mild category was excluded. However, with all three types of tongue thrusts included, the number of younger cleft palate and the younger noncleft palate who tongue thrusted were almost identical, although the tendency remained for a tongue thrust to be more prominent

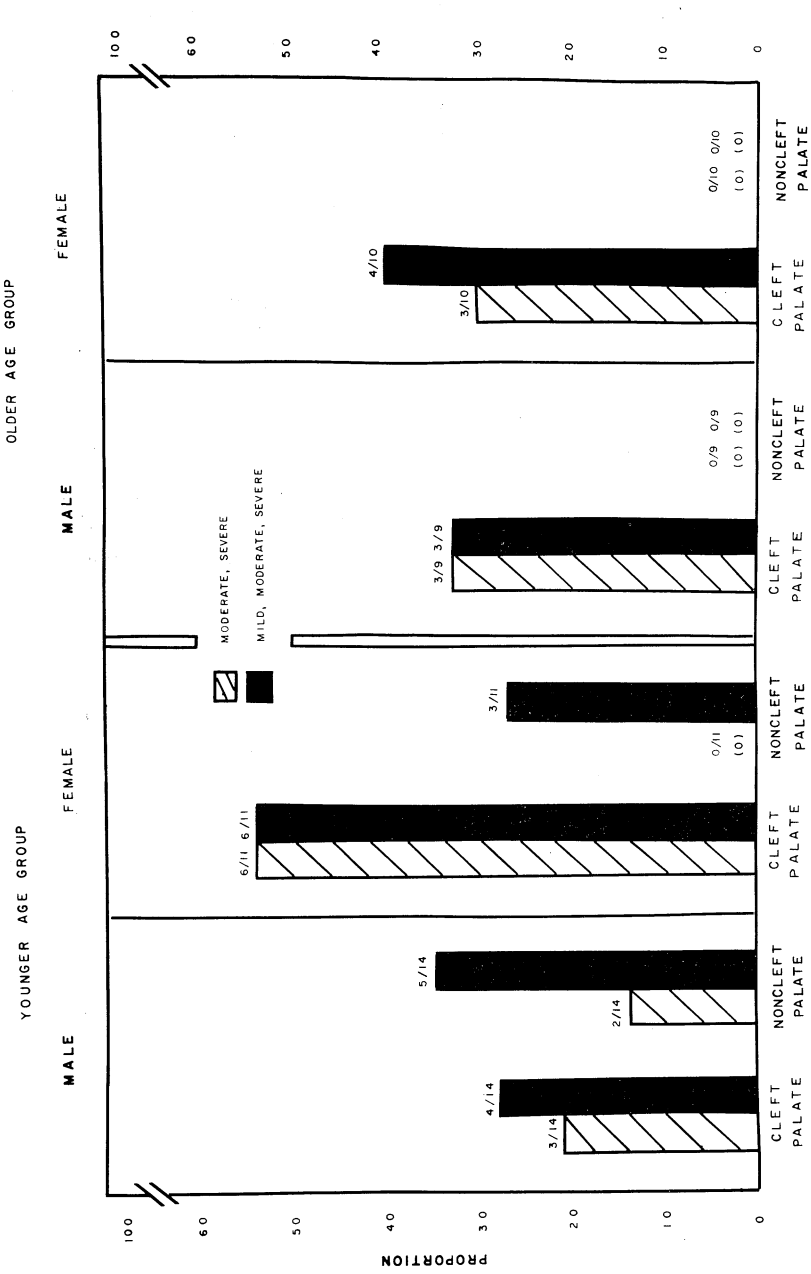

FIGURE 1. The proportions of subjects who show tongue thrust among the cleft palate and noncleft palate groups according to age and sex.

among the older cleft palate subjects than among the older noncleft palate subjects.

INTERDENTALIZATION. Data are presented in Table 2. A total of 70% or 31 of the 44 cleft palate subjects and 40% or 18 of the 44 noncleft palate subjects interdentalized at least one of the four sounds tested. The trend was the same for the two sex groups. As many noncleft palate subjects interdentalized as cleft palate subjects in the younger age-group; however, in the older age-group more cleft palate subjects showed interdentalization than did noncleft palate subjects.

An estimate of the severity of the interdentalizing problem was obtained by a count of how many of the four speech sounds /t, d, n, l/ were interdentalized, although I realize that these sounds mature at different ages during normal speech development. The cleft palate subjects who showed interdentalization did so on more sounds (Table 2) than did the noncleft palate subjects who interdentalized, regardless of age and sex.

There were no significant differences in the severity of the problem within the group of noncleft palate subjects who interdentalized, by either age and sex. As a whole, this group had a mild interdentalizing problem, interdentalizing usually only one sound, commonly /l/. Indeed, for the noncleft group, the /l/ was interdentalized significantly more than either the /t/, /d/, or /n/.

TABLE 2. The number of cleft palate and noncleft palate subjects who show interdentalization, according to age, sex, and speech sound. The proportion of subjects demonstrating interdentalizing is in parenthesis.

speech sound	*age-group I (younger)*		*subtotal*	*age-group II (older)*		*subtotal*	*total*
	male (total N = 14) N	*female (total N = 11) N*		*male (total N = 9) N*	*female (total N = 10) N*		
				cleft palate			
t	7 (.50)	7 (.63)	14 (.56)	6 (.66)	2 (.20)	8 (.42)	22 (.50)
d	7 (.50)	8 (.72)	15 (.60)	5 (.55)	2 (.20)	7 (.36)	22 (.50)
n	8 (.57)	8 (.72)	16 (.64)	6 (.66)	5 (.50)	11 (.57)	27 (.61)
l	7 (.50)	6 (.54)	13 (.52)	7 (.77)	5 (.50)	12 (.63)	25 (.56)
total	9 (.64)	9 (.81)	18 (.72)	7 (.77)	6 (.60)	13 (.68)	31 (.70)
				noncleft palate			
t	2 (.14)	0	2 (.08)	0	0	0	2 (.04)
d	2 (.14)	0	2 (.08)	0	0	0	2 (.04)
n	3 (.21)	0	3 (.12)	0	0	0	3 (.06)
l	7 (.50)	6 (.54)	13 (.52)	0	4 (.40)	4 (.21)	17 (.38)
total	8 (.57)	6 (.54)	14 (.56)	0	4 (.40)	4 (.21)	18 (.40)

Significantly more cleft palate subjects interdentalized /t/, /d/, and /n/ than did noncleft palate subjects (Table 2). In the younger age-group, however, this difference existed only between the cleft palate and noncleft palate females. In the older age group, the noncleft palate males did not interdentalize. In the older age group there were no significant differences among the cleft palate and noncleft palate females in interdentalization.

THE RELATIONSHIP BETWEEN INTERDENTALIZATION AND TONGUE THRUSTING. Of the cleft palate subjects, 45% of those who showed interdentalization also showed tongue thrust and 82% of those who showed tongue thrust also showed interdentalization. Of the noncleft palate group 28% of the subjects who showed interdentalization also showed tongue thrust and 40% of those who showed tongue thrust also showed interdentalization. Apparently, then, there was more of a tendency for those who showed tongue thrust also to show interdentalization than vice versa.

Discussion

It has been suggested that tongue thrusting is related to maturation (*24*). In my opinion, such reports are probably referring only to mild tongue thrusting patterns, such as those described in this study. Seventy-five percent of the younger noncleft palate subjects in this study who showed tongue thrust were considered to be mild, while there were no subjects with mild tongue thrusts among the older noncleft palate subjects. Perhaps noncleft palate subjects tend to "outgrow" the problem as they get older; therefore, the pattern of a mild tongue thrust is probably not clinically significant. More of the younger noncleft palate males showed tongue thrust than the younger noncleft palate females, which appears to parallel the commonly accepted statement that girls develop acceptable speech habits at a faster rate than boys. Subjects who tongue thrusted were just as prominent, however, among the older cleft palate subjects as among the younger cleft palate subjects, regardless of sex. One explanation of that finding is that the structural problem of a cleft palate may override the effects of maturation.

Orthodontic problems are quite prevalent among the cleft palate population. This study seems to point out another problem, tongue thrusting, which may inhibit or adversely affect orthodontic work. Perhaps tongue thrust behavior should be carefully considered by the orthodontist in planning treatment for the individual with a cleft palate.

Based on the findings reported here, it would appear that interdentalizing may be a normal process in the maturation of normal articulation. It is possible that noncleft palates who interdentalize outgrow their interdentalization as they grow older.

A speech clinician should be concerned about the interdentalizing among the cleft palate subjects. Although there may be little or no dif-

ference in the auditory aspects of an interdentalized and a normally produced /t/, /d/, /n/, or /l/, there is a difference in the visual aspects. Many persons with cleft palate have accompanying cosmetic problems which may distract some listeners. If a listener is also distracted by the visual aspects of speech there may be a reduction in the effectiveness of communication.

Summary

This investigation compared tongue thrust behavior during the act of swallowing and the interdentalization of /t/, /d/, /n/, and /l/ in 44 cleft palate subjects and 44 noncleft palate subjects, matched in sex and age. The following conclusions seem justified from this investigation. a) More cleft palate subjects were judged to demonstrate tongue thrust than noncleft palate subjects. b) Tongue thrust and interdentalization problems were more severe among the cleft palate subjects than among noncleft palate subjects. c) Incidence of tongue thrust behavior described as being mild in severity decreased with age among the noncleft palate group. d) The incidence of interdentalization on /t/, /d/, /n/, and /l/ decreased with age in the noncleft palate group. e) Both groups showed interdentalization on /l/; only the cleft palate group showed interdentalization on /t/, /d/, and /n/. f) There was a higher incidence of interdentalization among subjects who showed tongue thrust than there was of tongue thrust among subjects who showed interdentalization.

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