

Articulation Patterns of Preschool Cleft Palate Children

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Information available about the incidence of speech problems among cleft palate individuals is so variant that it is difficult to determine the extent to which speech habilitation services may be needed. For example, Bzoch (2) found that 45% of 60 cleft palate children, ages three to seven years, had speech that was difficult to understand and that an additional 45% had speech that was occasionally difficult to understand. His five-year-old cleft palate subjects had not developed articulation skills commensurate with the three-year-old control group. He concluded that the findings suggest a need for early articulation training, especially when the error types are of a gross nature involving the glottal stop and pharyngeal fricative substitutions.

Morley (5), however, reports that the majority of children gain normal speech spontaneously, having passed through a period of defective articulation. Her data on cleft palate children show that 60% of those three to four years of age, 42% of those four to five years of age, and 25% of those five to six years of age were found to have misarticulations. She, therefore, recommends delaying remedial speech services until the child is at least four years of age and suggests that it is indicated then only if the child exhibits a "severe" speech problem.

These two studies suggest that anywhere from 25% to 90% of the preschool cleft palate children may have speech problems. These studies also illustrate the controversy which exists as to whether or not speech training should be initiated early or should be postponed until the effects of maturational development of speech skills can be determined.

Studies of the misarticulations of cleft palate speakers demonstrate some characteristic patterns that are different from noncleft speakers. In a recent publication, Moll (4) comments on the need for further research about the misarticulations of cleft palate speakers. He suggests that the developmental aspects of articulation skills of children with cleft palates deserve study. We extend that comment by suggesting that knowledge of the developmental patterns would help define the need and time for

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This research was supported by Grant #2-6-061101-1553 from the U. S. Office of Education, Department of Health, Education, and Welfare.

introduction of speech stimulation activities and would help to determine appropriate procedures.

Barnes and Morris (1) report that information about the ability of cleft palate children to imitate speech sounds has prognostic and diagnostic value. They suggest that in addition to judging whether the response is correct or incorrect, effort should be made to judge the relative approximation to "normal" of the elicited imitated acoustic signal. In Travis (7), comment is made about the lingual difficulties of cleft palate speakers. When considering articulatory development, therefore, it may be of significance to determine the differences between cleft palate and noncleft speakers in ability to imitate both placement and sound production.

This study is part of a larger project designed to demonstrate the efficacy of speech and language stimulation for cleft palate infants. The purpose of this study is to describe the articulatory development of cleft palate children and to determine the need for remedial services.

The following specific questions were asked: a) What is the incidence of articulation problems among preschool cleft palate children? b) What role does maturation play in the improvement of the articulation skills of these children? c) What are the differences in the articulatory development of cleft palate and noncleft children? d) What are the patterns in development of articulation skills of cleft palate children? e) To what extent are cleft palate children able to correctly imitate articulatory placement for consonant sound productions and to correctly imitate the acoustic signal?

Procedures

There were 74 children between the ages of 24 and 72 months in the experimental group. These children had clefts of either the lip and palate or the palate only, but all clefts involved the soft palate. Initial surgical repair of the soft palate had been completed for all of these children. In the control group there were 127 normal children between the ages of 30 and 72 months who were attending nursery and kindergarten programs located in a large metropolitan community. Normal subjects between the ages of 24 and 30 months were not available.

All of the subjects in both the experimental and the control groups had normal intelligence as indicated by nonverbal tests of mental ability. None of the children in either group had received any remedial speech services prior to this study.

SPEECH EVALUATIONS. Intelligibility of the child's connected speech was rated by one of three examiners prior to any evaluation of articulation skills. Phrases and sentences were elicited by asking the child questions about pictures in the book *Come Over To My House* (3). This material was chosen because the stimuli easily prompted spontaneous verbal responses. Intelligibility of the speech samples was rated on the following scale: *one*, excellent (always intelligible); *two*, good (usually

intelligible); *three*, fair (intelligible); *four*, poor (partially intelligible); and *five*, unsatisfactory (completely unintelligible).

Articulation was evaluated by use of a test in which the production of 24 consonant sounds in various positions and 33 consonant blends was assessed. Pictures representing each of 100 test items were named for the child by the examiner. The child repeated each test word three times after the examiner. Each error response was classified as being one of three types: an omission, considered the most severe error; a substitution (including the glottal stop and the pharyngeal fricative); or an indistinct production (including distortion by nasal emission), considered the least severe error. The best production in the three attempts was recorded.

Ability to imitate production of 24 consonant sounds when combined with a neutral vowel was determined by having the child "watch and listen" as the examiner repeated each consonant sound combined with a neutral vowel. After three productions of the sound by the examiner, the child was then instructed, "Now you do it". The child's response was credited as one point if correct, one half point if questionable, or no point if incorrect. Two aspects of the response were rated separately for each sound: articulation placement and resultant acoustic signal.

It was not possible to administer the complete test battery to all children. For this reason, the N varied in relation to the test given.

Audiometric screening determined hearing levels of all the subjects. Children in the control group were excluded if found to have a hearing level poorer than 20dB (ISO-1964) at any frequency in the 500-2000 Hz range of the better ear.

RELIABILITY. Three experienced speech pathologists made the speech evaluations. Examiner reliability, as determined by interjudge correlations based on independent retest of 17 randomly selected subjects, was considered to be satisfactory. The coefficient of reliability for the articulation error scores was .93. On the articulation test, the maximum number of errors possible was 100. The interjudge error scores never ranged more than three points, with the exception of those on four subjects. The greatest amount of variation was 11 points. A correlation of .52 was obtained for the interjudge ratings of intelligibility. This is considered to be an indication of adequate reliability because the five point rating scale introduced a restriction which causes the correlation to be reduced. These ratings did not vary more than one point. A correlation of .64 was obtained on the interjudge evaluations of the imitated articulatory placement, and a correlation of .76 was obtained on the evaluations of the acoustic signal.

Results

ARTICULATION ERRORS. Data in Table 1 demonstrate the difference in number of articulation errors for the cleft palate and the normal subjects. Articulation scores were not obtained for normal subjects younger than

TABLE 1. Articulation error scores on a 100 item test. The data for mean articulation errors for the total group exclude cleft palate subjects below 36 months of age since there were no control subjects below that age.

<i>age</i> (<i>in months</i>)	<i>cleft palate</i>			<i>normal</i>		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
24 to 35.....	10	87.50	8.46	—	—	—
36 to 47.....	27	83.22	13.02	25	32.68	21.75
48 to 59.....	16	66.25	21.81	51	20.00	15.52
60 to 71.....	21	54.67	25.42	51	16.53	16.78
total group (36 to 71).....	64	69.61	23.35	127	21.10	18.25

30 months of age. On the articulation test in which 100 errors were possible, the mean number of errors for all the experimental subjects, ages 36 to 72 months, was 69.61, compared with 21.10 for the control subjects of similar ages. The number of articulation errors decreased as the chronological age level increased, but only four (6%) of the cleft palate children three years of age or older earned articulation error scores at or above the level of the three-year-old control group.

The large standard deviations indicated in Table 1 demonstrate the heterogeneity which can be expected in articulation skills. The failure to meet the assumption of homogeneity obviates the use of the *t* test. The difference between the means of the two groups is so obvious, however, that it is improbable that it can be attributed to chance.

The data clearly illustrate that a) these preschool cleft palate children were inferior to the normal children in development of articulation skills and b) the cleft palate children five to six years of age did not obtain a level of articulation development commensurate with the three-year-old controls.

INTELLIGIBILITY. As might be expected, the intelligibility ratings reflected the data for articulation error scores. Intelligibility levels of the cleft palate children, as shown in Table 2, improved with chronological age but were always poorer than those of the noncleft subjects. Moreover, the cleft palate subjects never reached the lowest level of the control group. The cleft palate children ages 36 to 72 months had a mean intelligibility rating of 3.83, compared with 2.20 for the control subjects in the same age range.

These data show that a) cleft palate subjects had poorer intelligibility than noncleft subjects and b) cleft palate subjects at any age level did not have speech as intelligible as the youngest (30 to 36 months old) normal group.

IMITATIVE ABILITY. The data presented in Table 3 show a difference between the imitative ability of the experimental and the control subjects. On the imitative ability test, the best possible placement score and

TABLE 2. Intelligibility ratings for cleft palate and normal subjects. The data for mean intelligibility ratings for the total group exclude subjects below 36 months of age since there were no control subjects below that age.

<i>age (in months)</i>	<i>cleft palate</i>			<i>noncleft</i>		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
24 to 35.....	10	4.70	.48			
36 to 47.....	25	4.28	.84	25	2.56	1.04
48 to 59.....	14	3.71	.91	51	2.22	.83
60 to 71.....	20	3.35	1.14	51	2.02	.93
total group (36 to 71).....	59	3.83	1.04	127	2.20	.93

TABLE 3. Imitative ability scores on a 24 consonant sound test. The data for the total group exclude subjects below 36 months of age since there were no control subjects below that age.

<i>age in months</i>	<i>articulation placement</i>						<i>acoustic signal</i>					
	<i>cleft palate</i>			<i>noncleft</i>			<i>cleft palate</i>			<i>noncleft</i>		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
24 to 35.....	10	10.00	3.65	—	—	—	10	7.90	3.91	—	—	—
36 to 47.....	23	10.87	5.20	25	20.88	3.39	23	8.39	4.99	25	19.88	3.53
48 to 59.....	14	14.89	5.90	51	22.47	1.87	14	12.46	5.89	51	21.42	2.26
60 to 71.....	20	17.02	5.69	51	22.25	2.26	20	15.57	5.79	51	21.43	2.63
total group (36 to 71)...	57	14.02	6.10	127	22.07	2.44	57	11.91	6.26	127	21.12	2.47

acoustic signal score were both 24 correct responses. The control group (36 to 72 months of age) earned a mean imitative placement score of 22.07 and a mean imitative acoustic signal score of 21.12, compared with means of 14.02 and 11.91 respectively for the experimental subjects in the same age range.

As indicated by both the mean scores and the standard deviations, the control subjects were earning scores close to the ceiling of the test, and little maturational change was possible. The experimental subjects, on the other hand, demonstrated greater variability in imitative ability as related to chronological age.

These data demonstrate that a) cleft palate subjects were consistently inferior to the noncleft controls both in ability to imitate articulatory placement for the production of speech sounds and in ability to imitate the acoustic signal of speech sounds and b) the cleft palate children, regardless of age level, never performed as well as the normal controls in imitation of either the articulatory placement or the acoustic signal.

TYPES OF ARTICULATION ERRORS. The misarticulations of the cleft pal-

TABLE 4. Percentages of misarticulations by cleft palate and normal subjects, according to type of error and age level.

<i>error types for single consonant elements</i>	<i>cleft palate</i>			<i>normal</i>		
	<i>36-47 mos.</i>	<i>48-59 mos.</i>	<i>60-71 mos.</i>	<i>36-47 mos.</i>	<i>48-59 mos.</i>	<i>60-71 mos.</i>
	<i>N 27</i>	<i>N 16</i>	<i>N 21</i>	<i>N 25</i>	<i>N 51</i>	<i>N 51</i>
fricatives.....	.98	.83	.73	.49	.35	.28
affricatives.....	.92	.84	.70	.42	.21	.12
glides.....	.71	.46	.39	.30	.18	.13
plosives.....	.70	.43	.31	.06	.02	.02
aspirants.....	.44	.25	.07	.02	.01	.01
nasals.....	.38	.30	.24	.05	.01	.03
voiced.....	.87	.70	.57	.35	.24	.17
unvoiced.....	.86	.68	.56	.29	.17	.15
initial.....	.69	.48	.39	.25	.17	.13
medial.....	.78	.63	.48	.26	.16	.13
final.....	.84	.68	.59	.31	.25	.15
indistinct production.....	.17	.16	.16	.04	.04	.04
substitutions.....	.27	.22	.22	.18	.11	.08
omissions.....	.33	.20	.10	.05	.02	.01

ate subjects were classified in relation to a) phonetic classification of the test sound, b) consonant voicing, c) place of the test sound in the word, and d) type of misarticulation.

As shown in Table 4, the order of difficulty of consonant sounds when grouped by phonetic classification was similar for cleft palate and normal subjects. Other similarities between the groups were the slight tendency to have more difficulty with voiced consonant sounds than with voiceless and the greater difficulty evidenced in production of final sounds than of initial or of medial sounds. The two groups were also similar in that the number of errors of omission decreased with chronological age, while the number of indistinct errors remained constant.

Aside from making a larger number of errors, the cleft palate subjects differed from the normal subjects in that medial sounds were more difficult than initial sounds; whereas for the controls, the medial and initial sounds were of nearly equal difficulty. Another difference between cleft palate and noncleft subjects is that substitution errors did not decrease appreciably with chronological age for cleft palate children as they did for the normal children.

Certain maturational trends were noted for the cleft palate subjects. They did not at any age level, or in any way except production of aspirants, approach the level of the three-to-four-year-old controls. Produc-

tion of fricative, affricative, and nasal sounds improved less with age than did other groups of speech sounds. The amount of improvement with age was about the same for voiced and voiceless consonants and about the same for initial, medial, and final sounds. Errors of omission showed a definite decrease with age and errors of substitution decreased slightly.

Discussion

These data show that the articulation error scores of 94% of the group of 64 preschool cleft palate children three years of age and older were inferior to the mean articulation scores of normal children of similar ages. The five- to six-year-old cleft palate children did not attain the proficiency of the three- to four-year-old control subjects. These findings, similar to those reported by Bzoch (2), suggest that these cleft palate children will enter the kindergarten and primary school years with atypical speech patterns which may handicap their educational and social development.

Variables such as hearing loss, age at time of surgical closure of the palate, and adequacy of velopharyngeal closure can affect speech development. It was not possible from this study to determine the extent to which each of these possible concomitants of cleft palate operated. It would be desirable to study articulatory development in relation to velopharyngeal closure. This, however, would make it necessary to determine the age at which velopharyngeal adequacy was achieved. Similarly, an isolated audiometric evaluation would not reveal severity, frequency, and duration of episodes of reduction in hearing levels and would not describe the relationships between the articulation problems and hearing. The universality of the inferior performance of the preschool cleft palate subjects suggests that for most of these children at least one and possibly a combination of factors, as mentioned above, was contributing to the delayed and defective articulation patterns. Furthermore, since none of these subjects had received any remedial speech services, it can be inferred that chronological maturation alone was not sufficient to promote normal speech development prior to six years of age. This leads to the conclusion that these children need speech stimulation and/or remediation regardless of whether or not the misarticulations are entirely functional when observed.

As shown in Table 4, generally the data which describe the articulation errors of the noncleft subjects are similar to those of Templin (6). The articulation error patterns of the cleft palate subjects suggest a generalized delay in development. This is indicated by the many similarities in the articulatory development of the cleft palate and normal subjects despite the greater number of errors made by the cleft palate children. General delay is also indicated by the difficulty the cleft palate subjects had in production of glides, nasals, and aspirants, sounds which

should not be affected by velopharyngeal inadequacy, and by the high percentage of errors of substitution and omission.

Apparently the articulatory confusions of these cleft palate children result in deceleration of normal maturational progress. Evidence of delayed development also suggests the desirability of early assistance in speech development.

This study contradicts the uniformity with which other investigators (4) report voiceless sounds to be more difficult than voiced for cleft palate subjects. The extremely high number of errors on cognates with regard to fricatives, affricatives, and plosives made study of differences in voicing almost meaningless. Study of specific cognate pairs showed that at these preschool age levels it was most common for cleft palate subjects to misarticulate both cognates. It is possible, therefore, that the pattern reported by other investigators is not clearly evident until later than six years of age.

Differences between cleft palate and normal subjects were observed on type of misarticulation. While both groups showed a decrease in errors of omission, only the normal subjects also showed a substantial decrease in errors of substitution. It may be surmised that the cleft palate subjects either are correcting only errors of omission or that these are being commuted to substitutions and indistinct productions. Errors of omission which showed the most maturational change may be those which can be most easily influenced by speech stimulation. The same may also be true of errors of substitution, which for the normal subjects showed definite maturational improvement.

The data in Table 3 on the ability of the cleft palate children to imitate consonant sound production give additional evidence of the severity of the articulatory handicap of these children. Information concerning the child's ability to imitate both the articulation placement and the acoustic signal of speech sounds would probably be of assistance in evaluating the extent and severity of the speech disorders of these children and also in prognosticating developmental improvement and/or the need for remediation. Furthermore, it may assist the speech clinician in determining training procedures. There is little chance of a correct acoustic signal production without the correct articulation placement. Clinically, it has been observed that emphasis on placement is often followed by an improved acoustic signal with very little additional effort on the child's part. Although the resulting acoustic signal may be an indistinct production (for example, one with nasal emission), this is considered preferable to a gross substitution or an omission.

Summary

A study was made of the articulation skills of 74 preschool cleft palate children and 127 noncleft children of similar ages. The findings showed articulation error scores, intelligibility ratings, and imitative ability scores of the cleft palate children were significantly inferior to

those of the controls. These findings support a rationale for providing a program of speech stimulation for all cleft palate infants when the palatal defects involve the soft palate. They suggest that early stimulation could assist the child in achieving speech development commensurate with his potential prior to entry in the primary years of school. Comparison of the patterns of articulation development of the cleft palate and normal children and study of their imitative responses provide suggestions for procedures to be used in a program of speech stimulation or remediation.

Acknowledgments: The authors gratefully acknowledge the assistance of George J. Mouly, Ph.D., statistical consultant; Asa J. Berlin, Ph.D.; Kenneth R. Bzoch, Ph.D.; and Rolland Van Hattum, Ph.D., who judged the connected speech samples; the Florida Crippled Children's Commission for arranging for evaluation of subjects, and the South Florida Cleft Palate Clinic for referral of certain of the subjects.

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References

1. BARNES, IDA J., and H. L. MORRIS, Interrelationships among oral breath pressure ratios and articulation skills for individuals with cleft palate. *J. speech hearing Res.*, 10, 506-514, 1967.
2. BZOCH, K. R., Articulation proficiency and error patterns of preschool cleft palate and normal children. *Cleft Palate J.*, 2, 340-349, 1965.
3. LESEIG, T., *Come Over To My House*. New York: Beginner Books, Random House, Inc., 1966.
4. MOLL, K. L., Speech characteristics of individuals with cleft lip and palate. Chapter 3 in *Cleft Palate and Communication*, D. C. Priestestersbach and Dorothy Sherman, eds. New York and London: Academic Press, 1968.
5. MORLEY, MURIEL E., *Cleft Palate and Speech*. Baltimore: The Williams & Wilkins Company, 1966.
6. TEMPLIN, MILDRED C., *Certain Language Skills in Children*. Minneapolis: The University of Minnesota Press, 1957.
7. TRAVIS, L. E., *Handbook of Speech Pathology*. New York: Appleton-Century-Crofts, Inc., 1957.