Perceptual Preferences Between Compensatory Articulation and Nasal Escape of Air in Children with Velopharyngeal Incompetence

EARLENE TASH PAYNTER, PH.D. MARTY W. KINARD, M.S.

Lubbock, Texas 79509

Three groups of children (eight with adequate velopharyngeal closure and normal speech, eight with velopharyngeal incompetence and compensatory articulation patterns, and eight with velopharyngeal incompetence and nasal escape of air) listened to 12 pairs of tape-recorded words. One word of each pair was produced with compensatory articulation, and the other was produced with audible nasal escape of air. Each subject indicated which word in each pair sounded better. The normal group and the group with velopharyngeal incompetence and nasal escape of air considered single words produced with compensatory articulation to be better than the same words produced with nasal escape of air. The group with velopharyngeal incompetence associated with compensatory articulation patterns did not consider such productions to be better perceptual approximations of standard phonemes than the alternative distortion from nasal escape of air.

Children who have insufficient velopharyngeal closure may display speech problems characteristic of their inadequate valving mechanisms. Nasal escape of air and the substitution of nonstandard English phonemes such as laryngeal or pharyngeal articulation may be characteristic of individuals with insufficient velopharyngeal closure (Bzoch, 1972: Van Riper, 1972). Consonants produced with nasal escape of air and the substitution of pharyngeal or laryngeal articulations are related to perceptual judgments of voice quality, instrumental measures of hypernasality, and articulation test scores (Bzoch, 1972).

A nonstandard or atypical sound substitution occurs when the individual articulates a sound which is beyond the physiologic, pho-

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Several authors have speculated as to why a child with inadequate velopharyngeal closure may use compensatory articulation patterns. McDonald and Keopp-Baker (1951) reported that a retracted tongue position was responsible for many articulation errors in speakers with cleft palate. They suggested that this pattern may develop in infancy as a means of preventing food from entering the nasal cavity. They also suggested that the retracted tongue might result from compensatory attempts to produce plosives or fricatives and lead to glottal stops or glottal fricative substitutions.

An explanation of the use of compensatory articulation patterns based on a reinforcement learning framework was proposed by Bzoch (1972, p. 113):

The insidious nature of such learned compensatory patterns of misarticulation appears to lie in the fact of very early habituation of extremely

Dr. Paynter is an Associate Professor in Speech Pathology at Texas Tech University, Lubbock, Texas. Mrs. Kinard is a Speech Pathologist in Paris, Texas.

Address Editorial Correspondence to: Earlene Tash Paynter, Ph.D., Speech and Hearing Clinic, Texas Tech University, Lubbock, Texas 79409 (806) 742-3900.

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atypical neuromuscular conditioned motor patterns used to form syllable pulses in speech. The patterns were almost always learned and reinforced in infancy and early childhood.

A different theory, however, was proposed by Morris (1972, p. 138):

Apparently some speakers with velopharyngeal incompetence consider the glottal stop as being a better approximation of certain plosives, for example, than a nasal distortion and so they adopt that response as a substitution for these plosives.

Morris's hypothesis to the effect that individuals who develop compensatory productions consider them to be perceptually better than the alternative nasal escape of air was the focus of the present study. If this hypothesis is true, one would expect that individuals who do not use compensatory articulation patterns would not consider compensatory productions to be better perceptual approximations than nasal distortions. Such a finding would be true only if the perceptual judgment of "better" were the only factor underlying the development of compensatory articulation patterns.

Purpose

The purpose of this study was to answer the following questions: 1) Do children who develop compensatory articulation patterns in response to velopharyngeal incompetence consider single words produced with compensatory articulation to be perceptually better than single words produced with nasal escape of air? 2) Do children who do not develop such compensatory articulation patterns consider single words produced with nasal escape of air to be perceptually better than single words produced with compensatory articulation patterns? 3) Do normal children with adequate velopharyngeal closure consider single word productions with compensatory articulation patterns or single word productions with nasal escape of air to be perceptually better?

Procedure

SUBJECTS. Twenty-four subjects, eight children with velopharyngeal incompetence associated with compensatory articulation (Group I), eight with velopharyngeal incompetency without compensatory articulation (Group II), and eight normal children (Group III), were included in this study. They came from the caseload of the Lubbock Cleft Palate Team. The subjects in both experimental group (I and II) demonstrated velopharyngeal incompetence as determined by the Team. The compensatory articulation in Group I was determined by two speech pathologists on the Team. Of these eight subjects, two had repaired unilateral complete clefts of the lip and palate; two had repaired submucous clefts; and four had velopharyngeal incompetence of undertermined origin. The audible nasal escape of air with no compensatory articulation found in subjects in Group II was also determined by two team speech pathologists. Of these eight subjects, two had repaired unilateral complete clefts of the lip and palate; two had repaired bilateral complete clefts of the lip and palate; and four had velopharyngeal incompetence of undetermined origin. Group III, the control group, was composed of eight subjects who had no past history of cleft palate, speech disorders, hearing loss, or mental retardation.

The sex ratio of the two experimental groups was not preestablished. Group I consisted of two males and six females. Group II consisted of seven males and one female. Four males and four females were included in the control group to approximate as closely as possible the sex ratio of nine males and seven females in the other two groups.

The ages of the two experimental groups also were not preestablished. Subjects in Group I ranged in age from five years, four months, to twelve years, two months with a mean age of seven years, nine months. Subjects in Group II ranged in age from four years, four months, to twelve years, nine months, with a mean age of seven years, eight months. After the selection of the 16 experimental subjects, the subjects with compensatory articulation patterns and the subjects with nasal escape of air were paired according to the closest age match. The mean age of each experimental pair was calculated, and one control subject was matched to each mean age within 6.5 months. The subjects in Group III ranged in age from five years, zero months, to twelve years, seven months, with a mean age of seven years, eight months.

All subjects passed an individually administered hearing screening test at 20 dB (ISO). CONSTRUCTION OF TEST TAPE. An audio experimental test tape consisting of a set of instructions, five pairs of practical words, and 14 pairs of test words was constructed. The equipment and procedures used are described elsewhere (Kinard, 1977).

The instructions indicated that the subject would be hearing two words. Both of the words would sound funny or wrong in some way. The subject was to tell the examiner which word, "one" or "two", sounded better. Each word pair consisted of the same word produced twice, once with a compensatory articulation pattern and once with nasal escape of air. The pairs of words were randomly arranged as to whether compensatory articulation or nasal escape of air was produced first. Table 1 presents the order of presentation of the 14 pairs of test words. For 10 of the 14 pairs, the compensatory articulation and the nasal escape of air were judged by the senior author to occur on the same phoneme in the word; and for the other four pairs, the compensatory articulation and the nasal escape of air were judged to occur in the same position of the word, i.e., at the beginning, in the middle, or at the end of the word.

TEST TAPE PRESENTATION. The experimental test tape was individually presented to each child using a Roberts (Model 770X) reelto-reel tape recorder. Each child was seated approximately three feet from the speaker. The tape was calibrated and presented to each subject at 80dB SPL. The examiner was seated directly across from the subject and recorded the responses on paper.

TABLE 1. Order of presentation of test words. "C" indicates that the word was produced with compensatory articulation. "N" indicates that the word

compensatory	articulation.	TN I	nuicates	that	the	woru
was produced	with audible	nasal	escape o	of air.		

1. Clown (N)	2. Clown (C)
1. Glasses (N)	2. Glasses (C)
1. Spoon (N)	2. Spoon (C)
1. Twins (N)	2. Twins (C)
1. String (C)	2. String (N)
1. Sun (C)	2. Sun (N)
1. Blocks (N)	2. Blocks (C)
1. Stopped (N)	2. Stopped (C)
1. Matches (C)	2. Matches (N)
1. Queen (N)	2. Queen (C)
1. Sleeping (C)	2. Sleeping (N)
1. Squirrel (C)	2. Squirrel (N)
1. Music (C)	2. Music (N)
1. Onion (C)	2. Onion (N)

TEST ITEM RELIABILITY. To determine the reliability of the test as recorded, a subject by item preference for compensatory production matrix was constructed. From the matrix, it was apparent that the 24 subjects differed in the way they perceived two items from the remaining 12 items. These two items (item number five, *string*, and item number six, *sun*) were excluded from any further analysis. A reliability coefficient (Kerlinger, 1973) for all 24 subjects using the 12 items was computed. The reliability coefficient (r = .63, p < .05) indicated that the 12 items test was sufficiently reliable.

Results

The percentage of compensatory articulation chosen by each subject was computed and converted to an Arcsin Transformation (Weiner, 1962). A single factor analysis of variance (Weiner, 1962) was used to determine if the three groups of subjects differed in their perceptual preferences. There was no significant difference (F = 1.55, p > .05) in the mean number of compensatory articulation productions chosen by the three groups of subjects.

A test of proportions for dichotomous data (Clarke, Coladarci, and Caffrey, 1965) was used to determine if there were differences in the number of choices involving compensatory articulation as opposed to those involving nasal escape. Table 2 presents the results of the test of proportions for dichotomous data.

Six of the eight subjects in Group I chose words with compensatory articulation more often than they chose words with nasal escape of air. This proportion of subjects (CR = 1.06, p = .14) was not statistically significant. The children with compensatory articulation, therefore, did not consider the words produced with compensatory articulation more acceptable than words produced with nasal escape of air.

All eight of the subjects in Group II chose words with compensatory articulation more often than they chose words with nasal escape. This proportion of subjects (CR = 2.47, p = .007) was statistically significant. The children with nasal escape considered the words produced with compensatory articulation more acceptable than the words produced with nasal escape.

Groups	Proportion of subjects choosing C more often than N	CR	Р
Group I	6/8	1.06	.14
Group II	8/8	2.47	.007
Group III	7/8	1.77	.04

TABLE 2. Summary of test of proportions for dichotomous data. "C" indicates words produced with compensatory articulation. "N" indicates words produced with nasal escape of air.

Seven of the eight subjects in Group III chose words with compensatory articulation more often than they chose words with nasal escape. This proportion of subjects (CR = 1.77, p = .04) was statistically significant. The children with normal speech, therefore, considered the words produced with compensatory articulation to be more acceptable than words produced with nasal escape of air.

Discussion

The results of this study indicate that the normal children and the children with velopharyngeal incompetence but no compensatory articulation considered single words produced with compensatory articulation patterns to be better than the same words produced with audible nasal escape of air. The children with velopharyngeal incompetence combined with compensatory articulation did not consider the words produced with compensatory articulation to be better or worse than the same words produced with nasal escape of air. This finding seems to be at variance with Morris's (1972) hypothesis that children who develop compensatory articulation patterns do so because they consider those productions to be better perceptual approximations of standard plosives, fricatives, and affricates than the alternatives characterized by distortions from nasal escape of air. However, the subjects in this study did not have their own sound productions to choose from. They might have considered their own compensatory articulation productions to be better than their productions with nasal escape of air. It is also possible that the children in Group I had once considered compensatory articulation patterns to be better than productions with nasal escape of air but that, by the time of this study, they no longer considered compensatory articulation patterns to be better.

The findings that normal children and children in Group II considered single words

produced with compensatory articulation patterns to be better than words produced with nasal escape of air leads one to expect that, if most children and even adults prefer compensatory articulation patterns to nasal escape of air, they may reinforce the use of such patterns in children with velopharyngeal incompetence. Such a finding would be compatible with Bzoch's (1972) theory that compensatory articulation patterns are initially used by the child to form syllable pulses in speech, are learned and reinforced in infancy and early childhood.

The results of the present study point to the need for further research in two related areas. First, it would be beneficial to study the perceptual judgements of parents of children with velopharyngeal incompetence. If the parents judge compensatory articulation to be more acceptable than productions marked by nasal escape of air, they would be likely to reinforce these productions in their children's speech. Lynch et al., (1977) noted that parents of young children with cleft palates reported with apparent pleasure, the appearance of such productions in their children's speech. Second, the extent to which compensatory articulation patterns reduced intelligibility as speculated on by Moll (1968) should be experimentally determined. A knowledge of the degree to which compensatory articulation patterns reduce intelligibility might lead to further understanding of the development of such patterns.

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