Misarticulations of Cleft Palate Children Achieving Velopharyngeal Closure and Children with Functional Speech Problems

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Children with cleft palate who have acquired an adequate velopharyngeal mechanism after physical management may still exhibit speech problems. These problems may be related to any of several factors, including the effects of formerly-inadequate velopharyngeal closure, inadequate dentition, and faulty learning of the speech sounds. The misarticulations of children with 'functional' articulation disorders are frequently assumed to be the result of faulty learning (*2*). To the extent, then, that the articulation errors of children with clefts who achieve velopharyngeal closure are due to faulty learning of the speech sounds, one might expect that:

a) the two groups of children would exhibit, at least in part, similar types of articulation errors, and that

b) judges would have difficulty discriminating between the children with clefts and the children with functional articulation disorders on the basis of their articulation and nasal voice quality.

Similarity in the speech problems of these two groups of children would have important implications for further physical and therapeutic management of the child with a cleft. On the other hand, if differences can be demonstrated between the speech patterns of these groups, it is important to examine those factors which may account for the differences.

The present study was designed to investigate the following questions.

a) Do children with functional articulation disorders and children with cleft palates who have adequate velopharyngeal closure show differences in the number and type of misarticulations?

b) Do these groups differ with regard to judges' ratings of severity of articulation defectiveness and severity of nasal voice quality?

c) Are judges able to identify the type of speech problem represented by a sample of connected speech?

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This report is based on research which was supported in part by PHS Research Grant DE 00853, National Institute of Dental Research.

Procedure

SUBJECTS. Two groups of subjects were used in this study. Twenty-eight children with articulation disorders were chosen, using the criterion of failing to achieve the cut-off score for eight-year-old children on the Templin-Darley Screening Test of Articulation (*7*) to define limits for selection. Thirty-three subjects with a congenital cleft of the palate or of the lip and palate who demonstrated velopharyngeal competence, defined by obtaining a manometer ratio[1] of 1.00, served as the second group. No restrictions were made on the basis of the type of physical management utilized to close the palatal cleft. None of the subjects had a hearing loss greater than 15 dB (ASA standards) in the better ear (500, 1000, 2000 cps), or showed evidence of gross neuromuscular impairment. The functional articulation group ranged in age from 111 months to 168 months with a mean of 134.1 months (11 years, 2 months). The cleft palate group ranged in age from 108 months to 161 months, with a mean age of 135.6 months (11 years, 3 months). All subjects were thus older than age eight, the age at which children can be expected to demonstrate mature articulation skills.

SPEECH SAMPLE. A standard sample of speech was elicited from each subject, using a set of 13 test sentences constructed for a previous study (*8*). These sentences contained a total of 149 consonant sounds: 56 plosives, 33 fricatives, 31 nasal semi-vowels, and 29 glides. Twenty-one consonant blends appeared in various combinations. Each subject was asked to repeat the sentences after the experimenter, and the entire speech sample was tape recorded, typically in quiet surroundings but not in sound-treated rooms.

The recorded speech samples were prepared for judging in the following manner. Each sample was edited to delete the voice of the experimenter. The order of presentation of the 13 sentences was then randomized within each sample. Finally, the total group of samples was combined so that the cleft and the functional articulation subjects appeared in random order in a single series. The samples were then re-recorded on another tape, each sample preceeded by a number and followed by a five-second interval.

ARTICULATION ANALYSIS. An analysis of the recording of each subject's speech was made by one experimenter (DRV). In scoring articulation, each of the 149 consonant sounds was evaluated for correct-incorrect articulation, and if incorrect, categorized according to the manner of production of the error sound (fricative, stop-plosive, glide, nasal semi-vowel) as well as the type of error (distortion-oral, distortion-nasal, glottal-stop substitution, substitution, and omission). The reliability of the experimenter's judgments and of these categories has been described previously (*8*).

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[1] Manometer ratios were computed by dividing the manometer reading obtained with nostrils open by the reading obtained with nostrils occluded. A manometer with a bleed device, allowing a small leak of air, was utilized to minimize the occurence of tongue-palate valving.

SCALING PROCEDURES. Two judging sessions were used. During the first session, a group of 16 observers (advanced students in speech pathology) rated each of the speech samples for articulation defectiveness. A seven-point equal-appearing-intervals scale was used, with a rating of one to indicate normal articulation, a rating of four to indicate moderately defective articulation, and a rating of seven to indicate severely defective articulation, et cetera.

During the second session the same group of observers rated the speech samples for severity of nasal voice quality, again using a seven-point scale (a rating of one to indicate normal nasality, a rating of seven to indicate severely excessive nasality, et cetera). For this task the tapes were played backward, using the method described by Sherman (*4*) and Spriestersbach (*5*). During the same session, after a rest period, the observers classified the speech samples as to the type of etiological problem demonstrated. Judges were asked to assign one of the following diagnostic categories to each sample: normal speech, functional articulation disorder, stuttering, cleft palate, hearing loss, aphasia, cerebral palsy.

Inter-judge reliability of mean scale values over 16 judges was determined by intraclass correlation technique, adjusted for trend (*1*). The reliability coefficient for averaged ratings of articulation was .97 and, for nasality, was .85.

Results

ARTICULATION ANALYSIS. The results of the articulation analysis are summarized in Table 1. The mean total number of misarticulations is almost identical for the two groups. The pattern of manner-of-production

TABLE 1. Mean scores and *t* values for the cleft palate and the functional articulation groups on the measures derived from articulation analysis. Values for *t* which are asterisked are significant at the 5% level.

measure	*group*		
	cleft palate	*articulation*	*t values*
total misarticulations	19.94	20.57	.20
manner-of-production errors			
fricative errors	10.52	11.46	.61
stop-plosive errors	7.97	5.93	1.27
glide errors	1.12	3.43	3.50*
nasal semi-vowel errors	.33	.57	1.33
type of misarticulation			
distortions-oral	9.61	10.18	.43
distortions-nasal	1.48	.61	1.34
substitutions	2.91	5.54	2.29*
omissions	6.09	5.18	.65
glottal-stop substitutions	.12	.04	.89

errors is essentially the same, both groups making the greatest number of errors on fricative sounds, with plosives, glides, and nasal semi-vowels following in descending frequency. However, the articulation group made significantly more errors on glides than did the cleft group.

The types of misarticulation do not follow the same pattern for both groups. In both cases, distortions-oral accounted for approximately half of the misarticulations, but the second-most-frequent type of error was substitutions for the articulation group and omissions for the cleft group. The articulation group made significantly more substitution errors than the cleft group.

SCALING PROCEDURES. The results of the scaling procedures are summarized in Table 2. The groups did not differ significantly with regard to either judged severity of articulation defectiveness or judged severity of nasal voice quality.

DIAGNOSTIC CATEGORIES. The diagnostic labels assigned to each of the speech samples are summarized in Table 3. While these data do not lend themselves to statistical analysis, it is interesting to note that for both groups approximately two-thirds of the judgments categorized the samples as representing either normal speech or functional articulation disorders. In only 24% of the judgments was the label of cleft palate assigned to the speech samples of the cleft palate children.

TABLE 2. Mean severity ratings and *t* values for judges ratings of articulation defectiveness and nasal voice quality. None of the *t*s are significant.

measure	*cleft palate*	*articulation*	*t values*
severity of articulation defectiveness	2.58	2.72	.09
nasal voice quality	4.16	3.65	.28

TABLE 3. Diagnostic labels assigned by judges to the speech samples. Entries are per cent of judgments assigning the various labels to speech samples in each of the two groups.

diagnostic category	*groups*	
	cleft palate	*articulation*
normal speech	43.0%	37.0%
articulation disorder	19.0%	36.0%
cleft palate	24.0%	8.0%
hearing loss	5.6%	8.5%
cerebral palsy	5.3%	6.7%
aphasia	1.5%	2.6%
stuttering	0.0%	0.6%

Discussion

It was assumed that both groups of subjects used in this study could achieve velopharyngeal closure, since the cleft group demonstrated that they could obtain a manometer ratio of 1.00 and since no structural deviations had been identified for the functional articulation group which were significant in speech production. Typically, the manometer ratio is regarded as only a gross measure of velopharyngeal competence and is usually used concomitantly with articulation tests and radiographic observations. However, in the present study, no significant differences were found between the two groups with respect to the number of errors on sounds requiring intraoral pressure, the number of nasal distortions of sounds, the number of glottal stop substitutions, or the judges' ratings of nasality, all of which are regarded as indicators of adequacy of velopharyngeal closure (*3*). In addition, the number of nasal distortion errors and glottal stops was quite low for the cleft palate subjects, a further indication that those subjects probably did achieve closure. In general, then, the findings tend to support the usefulness of the manometer ratio as a diagnostic tool for velopharyngeal competence.

Articulation analysis and scaled judgments indicate that subjects with articulation disorders considered to be functional and subjects with cleft palate present speech problems which are essentially similar in nature. It is interesting to note, for example, that there were no significant differences between the two groups in either the total number of errors or the number of fricative and plosive errors. The differences with respect to glide errors may be related to the fact that these sounds are often the last to be acquired in the speech sound learning sequence, and are among the most common errors in defective articulation. If the functional articulation group is late in the maturation of articulation skills, one might expect more errors on these sounds. The number of glide errors for both groups (3.43 for the articulation group and 1.12 for the cleft group) was small in relation to the number of glide sounds tested, 29 in all.

Analysis of the type of error also shows considerable similarity. There was no significant difference in the number of oral distortions, which accounts for approximately one-half of the misarticulations in each group. There was no significant difference in the number of nasal distortions or nasal emissions, a type of error which has been reported as being often observed in the speech of individuals with cleft palates. There was no significant difference in the number of omissions. For both groups, however, the number of omissions seems high in view of the fact that the mean severity ratings of 2.58 (cleft group) and 2.72 (articulation group) indicate fairly mild articulation problems. This may be a result of the test stimuli, since omission of sounds is a fairly typical error in any sample of connected speech. The articulation group had significantly more substitution errors. This finding is consistent with the number of glide errors shown by

the two groups, since misarticulations involving glide sounds often tend to be substitutions, particularly that of /w/ for /r/ and /l/.

The diagnostic labels assigned to the speech samples suggest that many of the children in both groups sounded 'normal', even to trained judges. Certainly the judges were not always able to identify samples of cleft palate speech. No subject in either group was assigned to the same category by all of the judges; however, they tended to be 'correct' (in terms of assigning appropriate labels) more often in identifying samples of defective articulation than in identifying samples of cleft palate speech. It is interesting that 19% of the samples of cleft palate speech were labeled as samples of defective articulation, while the reverse was true for only 8% of the articulation samples. Thirteen of the 33 cleft subjects were never identified (by any judge) as having a cleft. An additional nine subjects were identified as having a cleft by four or fewer of the 16 judges.

In summary, then, it is apparent that the cleft palate child who achieves velopharyngeal closure is free from many of the speech characteristics which typify 'cleft palate speech', that is, nasal distortion of sounds, glottal-stop substitutions, and excessive nasal voice quality. Other types of misarticulations are similar in number and type to those of the child with a 'functional' articulation problem. It may be that some children within such a group exhibit residual errors resulting from former velopharyngeal insufficiency; for the majority, however, it seems appropriate to consider a therapeutic approach which concentrates on correcting faulty articulation, and specifically, an approach which involves the principles in articulation therapy for children with functional problems.

Summary

A standard sample of connected speech was obtained from 28 children with articulation disorders considered to be functional and 33 children with a physically-managed cleft palate who could achieve a manometer ratio of 1.00. The speech samples were analyzed for articulation errors, and a group of judges rated the samples on the basis of articulation defectiveness and severity of nasal voice quality. The judges also assigned a descriptive diagnostic label to each speech sample.

The results of the articulation analysis showed that the articulation group made significantly more substitution errors and misarticulated significantly more glide sounds than did the cleft palate group. There were no other differences between the two groups in the total number of errors, the number of errors in manner of production, or in type-of-misarticulation. There was no significant difference in judges ratings of articulation defectiveness and nasal voice quality. The label of cleft palate was assigned to the speech samples of the cleft palate children in only 24% of the judgments. Approximately two-thirds of the judgments categorized the cleft palate samples as representing either normal speech or functional articulation disorders.

It appears that when a child with a cleft palate achieves velopharyngeal closure, it is difficult to differentiate his speech from that of a child with a functional articulation disorder. Therapy, then, can be essentially the same for the two groups.

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