Oral Language Skills of Adult Cleft Palate Speakers

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Cleft palate children are reported (24, 28, 32, 33, 34) to be delayed in language development, however, the language status of adults with cleft palate has not been described (35). To date, investigations of adult cleft palate speakers have been confined to voice and articulation skills. There is evidence (10, 24, 25) to indicate that in cleft palate children there is a relationship between articulation and language skills. According to Morris (24), speakers with defective articulation may not talk as much or know as many words as speakers with less defective articulation. Similar observations have been reported by Westlake and Rutherford (45) and Faircloth and Faircloth (10). McWilliams (20), on the other hand, has indicated that cleft palate children have problems with expressive encoding regardless of whether speech is normal or defective. Several studies (7, 18, 19, 36, 42) have demonstrated that adult cleft palate speakers are deficient in articulatory skills. Counihan (7), for example, reported that twenty percent of his adolescent and adult cleft palate subjects presented poorer articulation skills than the average three year old normal child, and that more than half were below the average five year old level.

The research on language skills in cleft palate children and articulation proficiency in adult cleft palate speakers would seem to suggest that in adults: (a) articulation proficiency and/or intelligibility may be related to language skills, and (b) language skills of cleft palate speakers may differ from those of normal speakers. The validity of these concepts, however, has not been investigated.

The purpose of this study was two fold: (1) to investigate selected oral language skills in cleft palate and normal adult speakers, and (2) to determine the relationship between oral language skills and intelligibility in adult normal and cleft palate speakers.

Method

SUBJECTS. The experimental group consisted of twenty subjects with congenital cleft palate, seven males and thirteen females, ranging from

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nineteen to twenty-six years of age. Eleven of the subjects had clefts of the lip and palate, and nine had clefts of the palate only. The cleft palate classification excluded individuals with bifid uvula, cleft lip only, clefts due to trauma, submucous clefts, congenital palatal insufficiency, and unrepaired clefts. All clefts had been physically managed; seventeen subjects had post-operative clefts of the lip and palate or palate only, two had prostheses, and one had a pharyngeal flap. All subjects had normal hearing, that is, no loss greater than 20 dB (ISO, 1964) for the better car at 500–2000 Hz.

The control group contained twenty normal adult speakers. Control subjects, selected from unsophisticated normal speakers, were matched to the cleft palate subjects with respect to age (not more than one year's difference), sex, hearing, socioeconomic level (23), and intelligence (nine points on two performance subtests of the Wechsler Adult Intelligence Scale, 43).

PROCEDURE: SPOKEN LANGUAGE SAMPLE. Connected speech was elicited and tape recorded in two stimulus situations: first, responses to pictures from the Speech Appearance Record (2), and second, conversation with the investigator generated by a proscribed set of questions. To determine testretest reliability, a second language sample was obtained in exactly the same manner as the first from one-fourth (ten) of the subjects.

A typewritten transcript of the first sixty responses elicited from each subject was prepared for analysis. The first ten responses were eliminated since they tend to be shorter and less complex than subsequent responses (17). Measures from analysis of each speech sample included response length (mean length of response; standard deviation of response length; number of words in longest response; number of one word responses, and mean of five longest responses); sentence structure (structural complexity score, and length complexity index), and vocabulary (number of different words, and type-token ratio). The scoring methods used were those described by Templin (37), McCarthy (17), Johnson, et al. (14), and Miner (21).

The following measures of vocabulary size (in addition to number of different words and type-token ratio) were used: recognition vocabulary level on the Peabody Picture Vocabulary Test (8) and expressive vocabulary level on the Wechsler Adult Intelligence Scale Vocabulary subtest (43).

SCORER RELIABILITY. The reliability of the scoring procedure was determined for both intrascorer and interscorer agreement. Ten of the samples were scored by the investigator three weeks after initial scoring to obtain an intrascorer reliability correlation. Ten of the samples were also scored by a graduate student in speech pathology. Intrascorer and interscorer reliability was computed using the Pearson r formula. The resulting correlation ranged from 0.94 to 1.00 indicating the experimenter was satisfactorily consistent in scoring responses and consistent in scoring agreement between two examiners.

PROCEDURE: INTELLIGIBILITY SAMPLE. Each subject recorded randomized 50-item CNC word lists from the Lehiste-Peterson List (16). Subjects were

first instructed to read the material once for practice. All recordings were made in a sound treated room with a tape recorder (Ampex, Model 86) and microphone (Ampex, Model 501). Subjects were positioned approximately twelve inches from the microphone, and the record level meter was monitored to fluctuate within the green area. Words were spoken at five second intervals in response to the signal of a blink light which alerted each subject to say the next word from his list. A set of listening tapes was prepared by dubbing the individual recordings in random order.

LISTENER JUDGEMENT PROCEDURE. Two groups of ten individuals each were used as listeners for the intelligibility measurement. One group, considered to be sophisticated listeners, were advanced graduate students in speech pathology who had extensive listening and therapy experience with cleft palate speakers. The other group, considered to be unsophisticated listeners, were untrained in speech pathology and phonetics, and reported that they had never heard a cleft palate speaker. None of the listeners had a history of any hearing loss.

All listening tasks were performed in a low ambient-noise environment with listeners seated facing a high-fidelity tape recorder (Ampex, Model 86) and an amplifier-speaker (Ampex, Model 516). Two listening sessions were conducted, one for the sophisticated listeners, and one for the untrained listeners. In both listening sessions, identical instructions were given and each listener was required to write down on a score sheet the entire word which he thought was spoken.

INTELLIGIBILITY SCORING PROCEDURE. A listener's response was scored as correct if it was the word intended by the speaker. Intelligibility was measured in terms of the number of words correctly identified by listeners. Two intelligibility scores were computed; total intelligibility, the total number of correct responses for each speaker and for each population of speakers.

RELIABILITY OF INTELLIGIBILITY RATINGS. The reliability for the listener judgments was computed by means of the intraclass correlation coefficient. The first analysis was based upon the ratings made by unsophisticated judges for the normal speakers. Highly significant intercorrelation coefficients (r's = 0.6412 to 0.9934) were reported among 179 of the 190 ratings. Only eleven of the listener judgments showed little relationship to any of the others (r's = 0.2846 to 0.6093). Interjudge variability for the unsophisticated judges was negligible, i.e., there is comparatively little variability in unsophisticated listener judgments for normal speakers. These data demonstrate that the naive listeners had high levels of agreement on each of the twenty normal speakers. Lower correlations were obtained for the intelligibility ratings for normal speakers by sophisticated judges. The coefficients of correlation ranged from -0.2632 to 1.000. In general, the correlation coefficients were very low. Only thirty-four of the coefficients were significant (r's = 0.6750 to 1.000).

The correlations between unsophisticated listener judgments for cleft

palate speakers ranged from -0.7512 to 0.9509; 91 of the correlations coefficients were highly significant (r's = 0.6417 to 0.9509). These results suggest that untrained listeners can be considered to be reliable judges. There was a wide range of correlations between sophisticated listeners for cleft palate speakers (r's = -.5224 to 0.8836). The coefficients obtained for these ratings are only slightly better than the reliability coefficients for normal speakers, thirty-five of the coefficients were significant (r's = 0.6425 to 0.8836). This is interpreted to mean that sophisticated judges were unreliable in their agreement in rating speakers; however, they were somewhat more consistent in rating cleft palate than normal adult speakers.

Results

SPOKEN LANGUAGE MEASURES. Table 1 contains the means and standard deviations for the language measures. Also in Table 1 are the F ratios showing the differences between groups on the language measures. Statistically significant differences were found on four of the five response length measures: mean length of response, standard deviation of response length, number of one word responses, and mean of the five longest responses. Cleft palate adults tended to use shorter responses than normal adult speakers. Of the six sentence structure and vocabulary measure, only one, the number of different words, resulted in a significant difference between the two groups.

STABILITY OF LANGUAGE MEASURES. The temporal or test-retest reliability for the spoken language variables was computed by means of the intraclass correlation coefficient. The correlation coefficients were computed to determine the consistency of responses over two trials for the spoken language measure. Within the parameters of this study, the linguistic performance of the cleft palate group (r's -0.598 to 0.979) is more consistent than that of the normal group (r's = 0.160 to 0.886); in other words, the cleft palate group was more stable in their language usage from day to day. The results indicate relatively low temporal reliability for all language measures except number of different words for the normal speakers (r = 0.886). It thus appears that normal speakers are not very consistent in their language usage from day to day. The intraclass correlation coefficients revealed a higher temporal reliability for the mean length of response (r = .9793, cleft palate speakers; .7225, normal speakers) than for the length complexity index (r = .7954, cleft palate speakers; .3014, normal speakers).

INTELLIGIBILITY MEASURES. The means, standard deviations, and F ratio based on the intelligibility data are presented in Table 1. The obtained F was highly significant in favor of the normal speakers; the normal speakers had significantly higher intelligibility scores than the cleft palate speakers. The cleft palate speakers appeared to reflect greater variation in terms of intelligibility than normals as is seen by comparing the standard deviations for both groups.

The total number of correct responses made by all the listeners for each

measure	mean	standard deviation	F ratio
Mean Length of Response			
Cleft palate	11.09	4.27	4.15*
Normal	14.34	5.70	
Standard Deviation of Response Length			
Cleft palate	9.35	4.21	8.61^{+}
Normal	14.91	7.34	
Number of Words in Longest Re- sponse			
Cleft palate	42.25	18.52	8.64^{\dagger}
Normal	65.65	30.37	
Number of One Word Responses			
Cleft palate	5.25	3.32	2.31
Normal	6.80	3.12	
Mean of Five Longest Responses			
Cleft palate	31.58	13.41	8.05^{+}
Normal	48.57	23.19	
Structural Complexity Score			
Cleft palate	85.90	26.81	1.20
Normal	97.00	25.62	
Length-Complexity Index			
Cleft palate	10.55	4.87	1.37
Normal	12.33	4.71	
Number of Different Words			
Cleft palate	212.70	62.93	5.58*
Normal	261.15	66.64	
Type-Token Ratio			
Cleft palate	.394	.04	.03
Normal	. 390	.07	
Wechsler Adult Intelligence Scale			
Cleft palate	36.60	16.01	.68
Normal	41.25	19.43	
PPVT Raw Score			
Cleft palate	108.45	16.98	.34
Normal	112.15	22.57	
Total Intell gibility Score**			
Cleft palate	480.35	213.49	28.39^{+}
Normal	740.30	44.87	

TABLE 1. Means, standard deviations and results of analysis of variance for comparison of the cleft palate and normal groups on oral language and intelligibility measures.

* Significant at the .05 level; df 1, 38.

† Significant at the .01 level; df 1, 38.

** Maximum total number correct = 1000.

subject on the total intelligibility scores for the cleft palate speakers ranged from 18 to 734 with a mean of 480.35. The normal speaker's intelligibility scores ranged from 638 to 841 with a mean of 740.30. An examination of these scores shows that the CNC lists used for the intelligibility tests pro-

measure	total intelligibility	
Mean length of response	.5570*	
Standard deviation of response length	.5480*	
Number of words in shortest response	. 0636	
Number of words in longest response	. 5891†	
Number of one word responses	4017	
Mean of five longest responses	.5548*	
Structural complexity score	.5351*	
Length complexity index	. 4221	
Number of different words	.6961†	
Type-token ratio	.1520	
Peabody Picture Vocabulary Test	. 4420	
WAIS Vocabulary subtest	.5586*	

TABLE 2. Pearson product-moment correlations between the language measures and intelligibility for the cleft palate group.

 \ast Significant at the .05 level; df 18.

† Significant at the .01 level; df 18.

vided a broad range of intelligibility scores. It should be noted that six of the cleft palate speakers achieved intelligibility scores (ranging from 638 to 734) as high or higher than the poorest normal speaker, but none achieved the mean for the normal speakers.

Sophisticated listeners, individuals with past therapy and listening experience, judged cleft palate speakers differently than untrained listeners. This difference was in the direction of a lower rating by the sophisticated judges: that is, speech pathologists tended to rate cleft palate speakers poorer than unsophisticated listeners.

RELATIONSHIP BETWEEN LANGUAGE MEASURES AND INTELLIGIBILITY.

Pearson product-moment correlations among the language and intelligibility variables are presented in Table 2. As can be seen in Table 2, there was a significant relationship between intelligibility and language skills in adult cleft palate speakers. Two Pearson correlations coefficients were significant at the .01 level, these were number of words in the longest response and number of different words. Five variables significant at the .05 level were mean length of response, standard deviation of response length, mean of the five longest responses, structural complexity score, and Wechlser Adult Intelligence Scale Vocabulary subtest. No Pearson correlation coefficients between language measure and intelligibility for normal speakers were significant at the .01 level, or .05 level of confidence, i.e., there are no significant relationships between intelligibility and language measures for the normal speakers.

Discussion

Comparison of twenty cleft palate and twenty normal adult speakers revealed significant differences in response length and intelligibility. No significant differences between groups were found in sentence structure and vocabulary. This provides the basis for an interesting speculation. Shames and Rubin (30) found that in grammar, syntax, and fluency cleft palate children seem to catch up to normal children by about five years of age. Zimmerman and Canfield (46, p. 299) observed that by five cleft palate children "compared favorably in language usage with the average of their age group." Faircloth and Faircloth (10) reported that younger cleft palate subjects were below the established norms for language skills but that older subjects with clefts compared favorably or were superior. However, the findings of Philips and Harrison (31) and Smith and McWilliams (32, 33) indicate that the opposite is true; that is, there is a tendency for language skills in cleft palate children to become progressively more deficient with increased age. These data would seem to suggest that cleft palate individuals may develop language skills at a slower rate than normal throughout the early years but master these skills at a later age.

The apparent discrepancy in temporal reliability between the cleft palate and normal speakers may be partially accounted for by differences in language skills. Cleft palate speakers tend to use shorter responses and fewer number of words. One would expect this decrease in amount of verbal output to be reflected in less temporal variability. It is also likely that this trend may be accounted for by differences in intelligibility. Morris (25, p. 153) suggested "that speakers with more defective articulation may simply not talk as much or know as many words as speakers with less defective articulation." Furthermore, Spriestersbach, Darley, and Morris (34) reported that cleft palate children appear to be relatively consistent in response length and complexity.

The normal speakers were not very consistent in their language usage from day to day. This may be considered to be in agreement with Shriner (31) and Minifie, Darley, and Sherman (22) that language measures have a low temporal reliability, i.e., language performance is not very consistent over time.

The results indicate that as a language measure the mean length of response is not as variable as the length complexity index; that it tends to measure language output more reliably over time. However, Barlow and Miner (1) reported that the length complexity index is a more consistent verbal measure than mean length of response and, therefore, tends to be a more stable indicator of verbal performance than mean length of response.

The results of this investigation indicate that there are significant differences between cleft palate and normal adult speakers in terms of listener judgments of intelligibility. These differences appeared in every comparison made between the two groups of speakers. The intelligibility scores of the cleft palate speakers were significantly lower than those of normal speakers. The results of this study and those of other investigators (7, 18, 19, 36, 42) suggest that in comparison to the present goals of cleft palate habilitation the speech results are often poor. An alternate interpretation is that a re-

examination of these goals is needed; that is, are "normal" articulation and voice quality realistic expectations. As Spriestersbach et al. (35) have pointed out approx, mately twenty-five percent of the individuals with treated palatal clefts fail to develop adequate speech; disorders of voice quality and articulation are the usual problems.

The results of the statistical treatment coupled with an examination of the data suggest that the intelligibility scores for normals tend to be close together and not vary from speaker to speaker as do the intelligibility scores for cleft palate speakers. The intelligibility of the normal speakers is surprisingly low in view of Weinberg and Paras' (44) observation that normal speakers should be expected to demonstrate near perfect intelligibility on closed set tests (4, 5, 9, 11, 13). Such a comparison, however, is questionable since in the present study a free response test of speech intelligibility was used. Tikofsky and associates (38, 39, 40, 41) used a free response test to investigate the intelligibility of esophageal, dysarthric, and normal speakers. Without exception, the mean scores obtained in the present study are lower than those reported by Tikofsky (38, 40) for normal speakers. A plausible explanation is that this represents listener variation rather than speaker variation.

The data reported here regarding the reliability of unsophisticated or untrained listeners are, in general, consistent with data reported by other investigators (12, 15, 27, 29). These findings indicate satisfactory levels of reliability for judgments of intelligibility by untrained listeners. However, in this study, the degree of variability which existed among the sophisticated listeners seriously impairs the reliability of their intelligibility judgments. The validity of this might be questioned, however, since Morrison (26) reported that the level of sophistication of raters has little effect on measurement reliability. In view of these results and those of other investigation, it is of interest to consider Perrin's (27) speculation "is the opinion of the lay person, who has no formal training in speech therapy, valid or is it only the speech therapist who can evaluate a person's speech." Another, more important consideration is the fact that in the final analysis it is the naive or untrained listener who constitutes the typical day to day listener for any given speaker.

It is an interesting parallel that Hoops and Noll (12) indicate that speech pathologists tend to rate speakers poorer than unsophisticated listeners. Bilger (3) has suggested that differences between listening groups reflects the relative inability of naive listeners to hear small deviations from normal. Perrin (27) and Burgi and Matthews (6) found that sophisticated and unsophisticated listeners rate speakers similarly.

Intelligibility and oral language skills as measured in this study are significantly related in adult cleft palate speakers. This relationship suggests that speakers who are difficult to understand may use shorter responses, not know as many words, and use less complex grammatical forms. Undoubtedly, the decreased response length is an attempt to improve intelligibility, that is shorter sentences are more apt to be understood by the listener. Of particular relevance is Faircloth and Faircloth's (10) hypothesis which suggests that there are two types of deviant oral language in children with cleft palates: (1) communicative intelligibility or articulophonetic accuracy in which sentence length, word length, and sentence complexity are reduced, and (2) language structure for intelligibility in which a wide variety of linguistic constrictions are used and intelligibility is reduced.

Consideration of the findings of this study and the possible relationship between intelligibility and language skills would seem to have implications applicable to the clinical situation. Poor intelligibility in adult cleft palate speakers would seem to demonstrate a definite need for further language assessment. Consideration must also be given to the possibility that therapy procedures designed to improve intelligibility, such as acceptable phonetic placement, may improve spoken language skills. This would seem to have implications in planning therapy programs for cleft palate children as well as cleft palate adults.

The correlation of intelligibility and language measures in the cleft palate group suggests the possibility that those who have "good" language may also be those who are able and motivated to work on their speech and vice versa. Thus, correlations of language and intelligibility measures with intelligence and educational level would be of interest.

Spriestersbach, et al. (35) suggest that the cleft palate population is quite heterogeneous in speech proficiency. Almost all investigations indicate that speech may range from normal to completely unintelligible. This variable should be considered in future attempts to identify the relationship between language skills and intelligibility in cleft palate speakers. Cleft palate speakers could be classified on the basis of intelligibility ratings and/or measures. It is highly possible that an inverse relationship between intelligibility and language would be found, that is the "better" the intelligibility the less related to language, and the "poorer" the intelligibility the more related to language ability.

Finally, there is a need to study language skills and intelligibility in cleft palate speakers in relation to a host of other variables: cleft type, type and age of management, effectiveness of management (cosmetic and palatal adequacy), birth weight, general health and development, associated congenital anomalies, cultural heritage, hearing level, intelligence, academic achievement, and socio-vocational status. Furthermore, Shames and Rubin (30) have called attention to factors such as parental attitudes, child rearing practices, medical and hospitalization histories, and speech and language stimulation and reinforcement. At the present time, the possible effects of these factors can only be speculated.

Summary

This study investigated selected oral language skills and their relationship to speech intelligibility in forty cleft palate and normal adult speakers.

Connected speech samples were analyzed to determine spoken language status which included response length, grammar or syntax, and vocabulary size. The subjects were judged for intelligibility by two groups of listeners: sophisticated and unsophisticated.

It was concluded: (a) cleft palate speakers used shorter responses and were more consistent in their language usage; (b) there were no significant differences in syntax and vocabulary; (c) for cleft palate speakers there was a relationship between intelligibility and language measures; (d) unsophisticated listeners were more consistent in intelligibility judgments, and (e) sophisticated listeners rated cleft palate speakers poorer than unsophisticated listeners.

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