Nasality and Cleft Uvula

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Studies of patients who present cleft-palate-speech in the absence of a cleft have been reported by Randall, et. al., (*5*), Blackfield, et. al., (*1*), Blakely (*2*), and Mason and Pruzansky (*4*). In general, these studies have attempted to increase our understanding of this problem and improve clinical management. One of the more specific management proposals to emerge from these studies was contained in the Mason and Pruzansky report. They reviewed the physical status of 110 patients who presented cleft-palate-speech in the absence of a cleft. One of their purposes was to identify morphologic features which would aid in identification of patients who may develop velopharyngeal inadequacy following adenoidectomy. They identified one or more of the following morphologic features in 85% of the patients they reviewed:

Uvula: not present, short, bifid, asymmetrical

Soft Palate: short, midline defect, deviant muscle insertion

Hard Palate: bony defect, submucous cleft

They found that 24% of the 110 patients developed cleft palate speech subsequent to adenoidectomy and concluded that the above morphologic features should be considered when an adenoidectomy is planned.

At the same time Blakely (*2*) presented data which do not appear to support Mason's and Pruzansky's conclusions. He examined 6,304 school-aged children for the following morphologic signs:

Uvula: cleft, blunted, short or virtually absent; pulls or points to one side during rest and/or phonation

Soft Palate: submucous cleft, asymmetrical and/or pulls to one side

Hard Palate: submucous cleft

Blakely found one or more of these signs in 5.8% of his subjects. Fifty-seven percent of the subjects with one or more signs had adenoidectomy and less than one percent was judged by him to be hypernasal.

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The potential significance of Mason and Pruzansky's observations and the extent to which Blakely's report challenges their significance led to the present study. The strategy used here was similar to Blakely's. It involved a population survey: identification of subjects with a certain morphologic sign and evaluation of their speech. The question asked was: "Do subjects with cleft uvula differ from subjects with normal uvula in the degree of hypernasality in their speech?"

Procedures

SUBJECT SELECTION. Subjects were selected from students attending a United States Bureau of Indian Affairs (USBIA) High School at Fort Wingate, New Mexico. Permission to use Navaho high school students as subjects was obtained from the USBIA, United States Public Health Service, the Council of the Navaho Nation, and the Fort Wingate High School administration. The choice of the Navaho as a subject was based on the results of a previous study by Shapiro and Cervenka (*6*) which indicated a high prevalence of cleft uvula among Chippewa Indians.

Subjects were divided into an experimental (cleft uvula) and a control group. Information concerning the distribution of age and sex of subjects is presented in Table 1.

The age group used represents the oldest students in the population available for study. Since Mason and Pruzansky reported that cleft uvula was the single most significant sign identified in their study, we chose to study subjects with this sign. We reasoned that a marginally adequate velopharyngeal closure mechanism would be most likely to fail when the distance the soft palate has to travel is at its maximum. This condition would most likely be present in a subject whose facial growth is nearly complete and whose adenoid tissue has begun to atrophy. Therefore, we chose to study the oldest group of subjects available to us.

Criteria for inclusion in the experimental group included the presence of a cleft uvula and the absence of any other major structural and functional abnormalities. A uvula was considered to be cleft when it was identified

TABLE 1. Sex and age of control and experimental (cleft uvula) subjects

	Number of Subjects	*Mean Age (years)*	*Standard Deviation*
Experimental Subjects			
Males	43	17.9	1.4
Females	33	17.3	1.4
Total	76	17.6	1.4
Control Subjects			
Males	36	17.8	1.6
Females	29	17.7	1.8
Total	65	17.8	1.7

by an experienced examiner* and verified by a second experienced observer. Upon verification, cleft uvulas were assigned by examiners to one of the following catagories.

B—uvulas cleft up to one fourth of the total length

C—uvulas cleft from one fourth to three fourths of the total length

D—uvulas cleft from three fourths to the total length

Judgments of the presence of major structural abnormalities, other than those associated with the palate, were made on the basis of visual observation.

Data on subjects rejected because of structural abnormalities were not kept. Five subjects were rejected because they reported hearing losses and two subjects were rejected because they stuttered.

Control subjects were matched with experimental subjects on the basis of age, sex and the absence of structural or functional abnormalities, including cleft uvula. These judgments were made by the investigators. Data were not obtained on subjects rejected from the control group.

The total number of subjects used in the study was determined by the time required to collect data and the total time available for the study. After an experimental subject was identified, his control became the next suitable student. Data were collected from 87 experimental and 83 control subjects. Final analysis was made on 76 experimental and 65 control subjects. Speech samples from those not included in analysis were eliminated due to poor recordings or incomplete identifying information.

Speech Samples. In order to obtain nasality judgments each subject read a standard passage of 4th grade reading level and recorded it on magnetic tape. Recordings were made at 7½ inches per second on a portable recorder (Uher, 4000) with its associated condenser microphone in an isolated room which was judged to have a low ambient noise level. During the first reading of the passage the experimenter adjusted the tape recorder to an appropriate loudness level and the second reading was recorded along with an identification number.

Preparation of the Experimental Tape. An experimental tape was constructed for use in obtaining nasality judgements. Ten-second segments of speech were extracted from each subject's recording, assigned a random number and dubbed onto a master tape. They were preceded by a voice announcing the segment number and followed by five seconds of silence. In preparing the master tape, the investigator played the original recordings on the same recorder (Uher, 4000) used to collect the original samples. The output of that recorder was jacked into the input of a second tape recorder (Ampex, 601) which was used to record the experimental tape.

Nasality Scores. Nasality scores were defined as the mean of nasality ratings obtained from 21 raters. Raters were recruited from students enrolled in an introductory college public speaking course.

* Examiners were 2 oral pathologists who had participated in previous studies of cleft uvula.

A direct magnitude-estimation procedure was used to obtain nasality ratings. Prior to rating sessions, one experimenter selected a standard sample which was judged to be toward the middle of the range of nasality represented on the experimental tape. The standard sample was assigned a value of 100 and was presented immediately before the presentation of the speech samples to be rated.

Ratings were obtained at two rating sessions. Eleven raters attended one session and ten attended the other. Conditions were judged to be the same for both sessions. Raters were seated in a 14 by 20 foot room facing a table at one end of the room. The tape was played on a floor model tape recorder (Ampex, 403) through a speaker-amplifier (Ampex, 620) placed on the table. Rating sheets were distributed and recorded instructions preceded the speech samples. Responses to questions from the raters were made by reading appropriate portions of the instructions presented on the tape.

Nasality scores were obtained by computing the mean of the 21 ratings assigned to each sample. These scores were used in subsequent data analyses.

Nasality Problems. Three experienced speech pathologists listened independently to the experimental tape and identified samples which, in their opinion, contained nasality problems of clinical significance. Any sample selected by all three speech pathologists was identified as presenting a nasality problem.

Results

An analysis of nasality scores for experimental, control, and various sub-groups is contained in Table 2. Differences between means of nasality scores for all groups were small. The only differences which appeared to be of significance were those between male and female sub-groups. These differences were present in the control and the experimental groups.

An analysis of the relationships between nasality scores and age is presented in Table 3. The only relation significantly different from zero was that between nasality scores and age of males in the experimental group. In this instance nasality scores decreased as age increased.

Twelve subjects were identified as having nasality problems. Eight of these subjects were in the experimental group and four were in the control group. Nine of the twelve subjects were males. Nasality scores for all twelve subjects were more than one standard deviation above the means for the experimental group and for the male experimental group, seven subjects' scores were more than two standard deviation above the same means.

Discussion

Nasality scores obtained in this investigation do not support the notion that cleft uvula, as found in a school age population of Navajos, is associated with hypernasality. Data did indicate that with procedures

TABLE 2. Comparison of groups using mean nasality scores

Subjects Compared	*Number of Subjects*	*Mean*	*Standard Deviation*	*t-score*
1. Experimental to Control				
Experimental	76	157.1	40.0	.80
Control	65	162.5	17.8	
2. Experimental Subgroups to Control				
a. Experimental B	33	146.0	42.8	1.86
Control	65	162.5	17.8	
b. Experimental C	35	163.6	37.6	.13
Control	65	162.5	17.8	
c. Experimental D	8	174.4	40.0	.79
Control	65	162.5	17.8	
3. Males to Females				
a. Experimental Males	43	176.5	37.0	5.68*
Experimental Females	33	131.9	17.3	
b. Control Males	36	181.0	32.1	4.72*
Control Females	29	139.5	38.9	
c. Experimental Males	43	176.5	37.0	.63
Control Males	36	181.0	32.1	
d. Experimental Females	33	131.9	17.3	.88
Control Females	29	139.5	38.9	

* These achieved a probability of $\leq .01$.

used to identify clinically significant nasality problems these problems may occur more frequently in subjects with cleft uvula.

This latter statement is in agreement with the association between cleft uvula and nasality noted by Pruzansky and Mason (4). In their study population consisting of individuals with clinical nasality a high proportion had cleft uvula. However, the lack of direct association between cleft uvula and nasality when a general population is surveyed indicates the complexity of identifying factors that may lead, or be related to the problem of clinical hypernasality. One approach that might add further information would be a contrast of individuals with cleft uvula and clinical hypernasality and individuals with cleft uvula and normal speech. These contrasts might include epidemiologic variables such as height and

TABLE 3. Correlations between age and nasality scores

Subjects	*Number of Subjects*	*Correlation Coefficient*
1. Control group	65	.00
a. Control males	36	−.11
b. Control females	29	.07
2. Experimental group	76	−.10
a. Experimental males	43	−.39*
*b. Experimental females	33	−.05

* Significant at the .1 level.

weight analyses as well as neurologic and morphologic examination of the velopharyngeal area.

Two other interesting findings were identified by this investigation. The first was the decrease in nasality scores noted in male experimental and control groups as age increased. This finding does not support the hypothesis that as the adenoid pad atrophies with age there will be increased opportunity for velopharyngeal incompetence. Indeed, if this hypothesis was valid, cleft uvula coupled with continual atrophy of the adenoid pad should have resulted in increased numbers of hypernasal individuals as our study population aged. This was not the case. The experimental male subject and to a lesser degree the control male showed a decrease in nasality scores as age increased. Both control and experimental female remain approximately the same in regard to nasality through time.

The other unexpected finding in the present study was that the listeners judged males to be more nasal than females. This finding was consistent throughout both the experimental and controls as well as the group judged to have a nasality problem. Possible explanations of this finding are that listeners are less accepting of nasality in males or that male voices have more of the acoustic variables which lead to the perceptual judgment of nasality.

In conducting the present study the investigators took advantage of an available population with a high prevalence of cleft uvula. There may be relevant factors which differentiate this population from other groups. Initially the investigators could not identify any significant factors of this type. However, in the course of the study, school authorities suggested that in the Navaho society great value is placed on physical adequacy. It is possible that children with severe nasality may be withheld from school even though school attendance is mandatory. The significance of this observation cannot be determined at this time.

Summary

This study attempted to evaluate relationships between cleft uvula and perceived nasality. Seventy-six subjects with cleft uvula and 65 controls were obtained from students attending a high school on a Navaho reservation. Recordings of connected speech were made and ten second samples were extracted and recorded in a random order. Nasality scores were derived from ratings made by twenty-one college students using a direct-magnitude estimation procedure. Nasality problems were identified by three experienceed speech clinicians. Data analysis revealed no difference between nasality scores of control and experimental groups. Nasality did not increase with age for either group. Eight of 12 subjects identified as having nasality problems had cleft uvula. It was noted that males were rated as being more nasal than females in the experimental and the control groups.

The authors conclude that data from this study do not support a direct relationship between cleft uvula and hypernasality in a population of Navaho school children. Rather, it indicates that a select but very small and at present indistinguishable segment of these cleft uvulas are associated with clinical nasality problems. The challenge that still remains is to determine the difference between two groups of people: cleft uvula-with normal speech, and cleft uvula-with clinical hypernasality.

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