Hearing Sensitivity of Adults with Cleft Lip and/or Palate

ELCA SWIGART, PH.D.
Lancaster, Pennsylvania 17602

This study is designed to investigate the *hearing* sensitivity of *adults* with repaired *clefts* of the *lip* and/or *palate* or congenital velopharyngeal inadequacy (*VPI*). Hearing sensitivity was analyzed with respect to pure tone air conduction thresholds and the extent of air-bone gap. In addition to age, *type of cleft* and type of *physical management* of the palate were taken into account.

The results of the study indicated that the thresholds of individuals with clefts of the palate or VPI are higher (poorer) than those with clefts of the lip only, but the mean thresholds for the better ears for all three groups approximate what has been frequently considered normal limits (25 dB or better). When the poorer ears were considered, several of the mean thresholds of the groups with clefts of the palate or VPI exceeded normal limits.

There were no significant differences in thresholds among the four types of palatal clefts or among the types of physical management of the palates.

Research has demonstrated that the incidence of hearing loss is significantly higher in individuals with cleft palate than in the non-cleft population. (Gaines, 1940; Gannon, 1950; Holmes and Reed, 1955; Means and Irwin, 1954; Miller, 1956; Sataloff and Frazer, 1952). However, the majority of the investigations concerning cleft palate and hearing included young children where the incidence of infection in the middle ear is greater than in older children or adults.

Although it has been recognized that hearing in children with cleft palate improves with age (Sweitzer, Melrose, and Morris, 1968; Heller, Hockberg, and Milano, 1970; Spriestersbach, *et al.*, 1962), little consideration has been given to the influence of repeated ear infection in the early years of life upon the hearing sensitivity in adulthood. Furthermore, the evidence that is available appears contradictory. Goetzinger, Brook, and Proud (1960) report that the 42 adults with cleft palate from 16 to 75 years had only a slightly shifted threshold and possessed hearing levels within the limits of normal hearing. Miller (1956) on the other hand, indicated that conductive hearing loss in individuals with cleft palate is progressive and that proper medical treatment is necessary to stabilize or eliminate deafness in adulthood.

There is also little agreement concerning the pure tone frequencies most affected by the repeated middle ear infections. In contrast to Sataloff and Fraser (1952), who found the predominant hearing loss in persons with cleft palate to be in the low frequencies, Miller (1956) reported that the very high frequencies (8000 to 12000 Hz) were the most frequently affected. According to Gaines (1940), there is a lessened perception for both high and low frequencies.

Studies treating hearing loss and cleft palate have also produced conflicting reports with respect to specific parameters which may or may not contribute to the losses. There is little agreement concerning the effect of the type of palatal cleft upon hearing loss. In contrast to Pagnamenta (cited by Skolnick, 1958) who reported the severity of the cleft to parallel the increase in the severity of hearing loss, several authorities found no relationship between hearing loss and the type of cleft (Gannon, 1950; Holmes and Reed, 1955;

Dr. Swigart is affiliated with the H.K. Cooper Institute for Oral—Facial Anomalies and Communicative Disorders and the Lancaster Cleft Palate Clinic, Lancaster, Pennsylvania 17602.

This paper was presented at the thirty-fourth annual meeting of the American Cleft Palate Association, San Francisco, California, 1976.

This research was supported by Public Health Service research Grant DE-02172—from the National Institute of Dental Research.

Goetzinger, 1960). Several additional investigators (Masters, Bingham, and Robinson, 1960; Spriestersbach, 1962; Heller, Hockberg, and Milano, 1970) reported the highest incidence of hearing loss in individuals with clefts of the hard and soft palate, while others (Sweitzer, Melrose, and Morris, 1968) indicated that the lip-plus-palate subjects have poorer hearing than the palate-only subjects.

The effect of various types of physical management of the palate, such as surgery or prosthetic appliance to aid speech, upon hearing has not been clearly established in the literature. Anthony (1976) reported that prosthetic management of patients with cleft palate was not detrimental to hearing sensitivity. Graham, Schweiger, and Olin (1962) in testing fifty-four patients before and after insertion of speech appliances found "no cases in which the hearing level at the last examination was worse than at the examination prior to the insertion of the obturator." On the other hand, several investigators (Masters, Bingham, and Robinson, 1960; Spriestersbach *et al.*, 1962) compared methods of repair and observed a higher incidence of hearing loss in patients who had been fitted with speech appliances. Skolnick (1958) also noted "a frequent association of . . . middle ear pathology with cleft palate prosthesis."

In many investigations it is not clearly specified whether the better or poorer ears or both were considered. Other variables such as hearing-loss criterion or age at time of testing were not consistent among the various investigations. Consequently, the data appear to be contradictory, and the relationship between hearing and the type of cleft or the type of physical management remains unclear.

In light of much contradictory evidence concerning cleft associated hearing loss, the present investigation was designed to evaluate audiometrically a group of adults with clefts of the lip and/or palate or with velopharyngeal inadequacy (VPI). In addition to the specified age bracket (adulthood) two other parameters were taken into account: 1) type of cleft and 2) type of physical management of the palate. Hearing sensitivity was analyzed with respect to pure tone air conduction thresholds as well as the extent of air-bone gap.

Method

SUBJECTS. Two-hundred forty-nine active patients at the Lancaster Cleft Palate Clinic between the ages of 15 and 55 served as subjects in this study. The group with clefts of the lip only included five patients; the group with clefts of the palate included 227 patients; and the group with VPI included 17 patients.

For portions of the study, the group with clefts of the palate was subdivided into four categories: 1) unilateral cleft of the lip and palate (N = 86); 2) bilateral cleft of the lip and palate (N = 57); 3) cleft of the hard and soft palate (N = 64); and 4) cleft of the soft palate only (N = 20). Each of the cleft palate subgroups was further divided into types of physical management of the palate: a) surgery only; b) surgery and a speech appliance; and c) speech appliance only. (See Table 1). For this investigation, surgical treatment of palatal clefts refers to any of several surgical procedures used to correct the palatal defect. No differentiation was made between one or more operative procedures.

Because of the limited number of patients in the groups with clefts of the lip or VPI, these groups were not subdivided for any analyses. The patients with VPI had received treatment for the palate by surgery (7 patients), surgery and a speech appliance (3 patients) and speech appliance only (7 patients).

TABLE 1. Number of patients with each type of palatal cleft in each category of physical management of the palate.

Type of palatal cleft	*type of physical management of the palate*			
	surgery only	*surgery and speech appliance*	*speech appliance only*	*total*
Unilateral lip and palate	21	49	16	86
Bilateral lip and palate	13	31	13	57
Hard and soft palate	4	29	31	64
Soft palate	5	7	8	20
				227

PROCEDURES. Each patient was seated in an acoustically treated room and was given a pure tone, air and bone conduction threshold examination with an audiometer (Beltone, 10-D) calibrated to ANSI-1969 standards. The bone conduction thresholds were assessed with mastoid placement of the oscillator and contralateral white noise masking. The pure tone stimuli were octave intervals from 125 to 8000 Hz for air conduction and from 250 to 4000 Hz for bone conduction.

A "better" ear and a "poorer" ear were determined for each patient. The ear with the more sensitive air conduction threshold for the mean of the speech frequencies (500, 1000, and 2000 Hz) was designated the "better" ear and the remaining ear was labeled the "poorer" ear. In the event the two mean thresholds were equal, additional frequencies were considered in the following order: 4000, 250, and 8000 Hz. For the 249 adults, the "better" ears consisted of 125 right ears and 124 left ears. All analyses were computed for the "better" and "poorer" ears separately.

A verbal questionnaire to assess histories of ear pathology, hearing loss, or medical and surgical treatment to the ears was administered to each patient. The five questions were:

1. Have you ever had hearing problems?
2. Have you ever had ear pathologies?
3. Have you ever taken medication for ear problems?
4. Have you ever had any operations on your ears?
5. Have you ever worn a hearing aid?

Results

AIR CONDUCTION THRESHOLDS

Frequency Analysis. Table 2 summarizes the mean air conduction thresholds at each frequency of the "better" ears for each of the three groups in this investigation: 1) cleft of the lip; 2) cleft of the palate; and 3) VPI. The mean thresholds for the "better" ears were within what has been frequently considered normal limits—less than 25 dB.* The group with clefts of the lip only exhibited lower (better) mean thresholds than the group with clefts of the palate at all seven frequencies tested. A three-way analysis of variance indicated no significant differences in thresholds between the group with clefts of the palate and the group with VPI. However, there were significant threshold differences among the seven frequencies (.01 level of confidence) within each of the groups. The ears were most sensitive at the middle frequencies which correspond to the speech frequencies (500, 1000, and 2000 Hz). Higher thresholds were obtained at both the high and low frequencies, but the thresholds were the highest at 8000 Hz for all three groups.

The mean air conduction thresholds at each frequency for the "poorer" ears for the three groups are presented in Table 3. The group with clefts of the lip only exhibited the lowest mean thresholds at all frequencies and were within what has been frequently considered normal limits. The mean thresholds for the group with clefts of the palate were not significantly different from those of the group with VPI and approximated the upper limits of the normal range. A three-way analyses of variance indicated significant threshold differences among the seven frequencies (.01 level of confidence) within both cleft of the

* The results of this investigation are in part discussed with respect to a range of "normal limits." The concept of "normal limits" has as its foundation an average of hearing sensitivity. An average was suggested from a national health survey in the U.S. by testing large numbers of young people (National Health Survey, 1938). Since an average is a hypothetical point around which responses may vary, the amount of variation permitted before the responses are considered "abnormal" is set in various ways. A common practice is to take two standard deviations as the range of normal. Ninety-five percent of the children who took the Bell Telephone Laboratories test at the World's Fair in 1939 fell within two standard deviations of zero hearing level for audiometer calibrated to the American Standard Association—approximately 15 dB on the ASA scale or approximately 25 dB on the currently used ANSI-1969 scale (see Davis and Silverman, 1960). Eagles, Wishik, and Doerfler (1967) studied hearing sensitivity and ear disease in children and suggested that the range of normal extended to 12 dB on the ASA scale (approximately 22 dB on the ANSI-1969 scale).

In reports of hearing sensitivity of individuals with cleft palate, the range for normal varies widely: 5 dB (Graham and Lierle, 1962) to 30 dB (Miller, 1959). Furthermore, it is in many instances difficult to state the actual range used because the standard of audiometer calibration was not indicated.

For discussion of the data on hearing sensitivity in this investigation, 25 dB on audiometers calibrated to ANSI-1969 standards has been selected to represent the limits of normal hearing because of the similarity to results of earlier large-scale investigations.

TABLE 2. Mean air conduction thresholds for the "better" ears of the cleft of the lip, cleft of the palate, and VPI groups.

Type of cleft	*frequency*						
	125	250	500	1000	2000	4000	8000
Lip	12 dB	8	3	3	3	7	16
Palate	17	15	13	12	9	16	23
VPI	18	15	15	13	13	12	19

TABLE 3. Mean air conduction thresholds for the "poorer" ears of the cleft of the lip, cleft of the palate, and VPI groups.

Type of cleft	*frequency*						
	125	250	500	1000	2000	4000	8000
Lip	11 dB	6	6	6	4	9	21
Palate	23	23	21	21	17	23	30
VPI	23	25	26	26	22	23	32

palate and VPI groups. Higher thresholds were obtained for both the high and low frequencies, and the "poorer" ears were least sensitive at 8000 Hz. The mean threshold at 8000 Hz was 30 dB for the group with clefts of the palate, and consequently, exceeded the range of what is generally considered normal limits. The mean thresholds at 500 and 8000 Hz for the group with VPI were 26 dB and 32 dB respectively, and also exceeded the range of normal limits.

Incidence of Hearing Loss. The incidence of hearing loss for individuals with oral clefts may vary with the criterion established to indicate loss. In Table 4 the percentages of patients in this study exhibiting air conduction hearing losses in the "better" ears and the "poorer" ears are presented by cleft type (cleft of the lip, cleft of the palate, or VPI). Three different criteria were used to indicate an air conduction hearing loss: 1) Mean of the speech frequencies 25 dB or greater, 2) Mean of the speech frequencies 15 dB or greater, and 3) Mean of the speech frequencies 5 dB or greater. With a criterion for a loss of 25 dB or greater for the mean of the speech frequencies, nine per cent of the group with clefts of the palate and six per cent of the group with VPI exhibited hearing losses in the "better" ear. When the "poorer" ears were considered, 26 per cent of the group with clefts of the palate and 29 per cent of the group with VPI exhibited air conduction losses of 25 dB or greater. No patient with a cleft of the lip only exhibited a mean speech frequency threshold of 25 dB or greater in either the "better" or "poorer" ears.

The percentages of patients with air conduction hearing loss of 15 dB or greater for the mean of the speech frequencies are also presented in Table 4. No patient with a cleft of the lip only exhibited a hearing loss of 15 dB or greater in either the "better" or the "poorer" ear. Twenty-seven per cent of the group with cleft of the palate and twenty-nine per cent of the group with VPI exhibited hearing losses of 15 dB or greater in the "better" ear. Forty-eight per cent and forty-seven per cent of the group with cleft palate and the group with VPI, respectively, exhibited hearing losses of 15 dB or greater in the "poorer" ear.

A very strict criterion of 5 dB or greater for the mean of the speech frequencies to designate a hearing loss was also considered and the percentage of patients exhibiting a hearing loss of that magnitude are found in Table 4. For the "better" ears 40 per cent, 80 per cent, and 82 per cent of the groups with cleft lip, cleft palate, and VPI, respectively, exhibited hearing losses of 5 dB or greater. When the "poorer" ears were considered, 60 per cent, 89 per cent, and 100 per cent of the above mentioned groups exhibited hearing losses.

Physical Management of the Palate. To deter-

TABLE 4. Percentages of patients who exhibited hearing losses as determined by the pure tone, air conduction thresholds for the mean of the speech frequencies (500, 1000, and 2000 Hz) in the "better" ears and the "poorer" ears.

Criteria for hearing loss	*type of cleft*				*VPI*	
	lip		*palate*			
	better ear	*poorer ear*	*better ear*	*poorer ear*	*better ear*	*poorer ear*
Mean threshold for speech frequencies 25 dB or more	0%	0%	9%	26%	6%	29%
Mean threshold for speech frequencies 15 dB or more	0%	0%	27%	48%	29%	47%
Mean threshold for speech frequencies 5 dB or more	40%	60%	80%	89%	82%	100%

mine the effect of various managements of the palate the patients with a cleft of the palate were classified according to the four types of palatal cleft: 1) unilateral lip and palate; 2) bilateral lip and palate; 3) hard and soft palate; and 4) soft palate only. In addition, the patients in each of these clasifications were divided into the three types of physical management of the palate: 1. surgery only; 2. surgery and a speech appliance; and 3. speech appliance only. (Refer to Table 1). The patients with a cleft of the lip only or VPI were excluded from this portion of the study. The results of a three-way analysis of variance for the thresholds of the "better" ears indicated no significant differences in thresholds among types of palatal cleft and no significant differences in thresholds among the three types of physical management.

The same analysis for the thresholds for the "poorer" ears indicated no significant difference in thresholds among the types of palatal cleft and no significant difference in thresholds among the types of physical management.

Air-Bone Gap

Frequency Analysis. The separation of the "better" and "poorer" ears as determined by the mean of the air conduction thresholds at 500, 1000, and 2000 Hz was maintained throughout the study of air-bone gap. The six subjects who wore hearing aids were eliminated from this portion of the statistical analyses because their thresholds appeared as outlying data and could result in false implications. The mean air-bone gap for each of the frequencies for the "better" ears of the groups (cleft of the lip, cleft of the palate, and VPI) is listed in Table 5. As might be expected, there was very little air-bone gap for the group with clefts of the lip only (range from 0 dB to 4 dB). The extent of air-bone gap was slightly greater for the group with clefts of the palate or VPI (2 dB to 9 dB). With the exception of the mean air-bone gaps at 250 Hz for the groups with clefts of the palate or VPI, no mean air-bone gap exceeded 6 dB. The larger air-bone gaps occurred at the low frequencies (250 and 500 Hz) for all three groups.

Table 6 summarizes the data for the air-bone gap for the "poorer" ears. The group with clefts of the lip only exhibited a mean air-bone gap at only one frequency. The groups with clefts of the palate or VPI exhibited mean air-bone gaps ranging from 5 dB to 15 dB. The largest air-bone gaps occurred at 250 Hz for all three groups.

Incidence of Hearing Loss. To determine the incidence of various extents of air-bone gap, the mean air-bone gap for the speech frequencies was calculated for each ear by averaging the difference between the mean air conduction thresholds and the mean bone conduction thresholds of 500, 1000, and 2000 Hz. The percentage of patients in each of the three groups (cleft of the lip, cleft of the palate, or VPI) who exhibited a mean air-bone gap of 5 dB, 15 dB, or 25 dB or greater for the mean of the speech frequencies are presented in Table 7. Data from all subjects, including those who wore hearing aids and were eliminated for the frequency analysis of air-bone gap, were included in the computation of percentages for this table. No patient with a cleft of the lip only had a mean air-bone gap as large as 25 dB in either the "better" or the "poorer" ear. Noting the "bet-

ter" ears, none of the subjects with clefts of the palate exhibited a mean air-bone gap of 25 dB, and only six per cent (one patient) of the group with VPI exhibited a mean gap of 25 dB or more. When the "poorer" ears were considered, 11 per cent (24 patients) of the group with clefts of the palate and 12 per cent (two patients) of the group with VPI exhibited a mean air-bone gap of 25 dB or greater.

The percentages of patients exhibiting mean air-bone gaps for the speech frequencies of 15 dB or greater are also listed in Table 7. For the "better" ears, six per cent (one patient) of the group with clefts of the palate and 12 per cent (two patients) of the group with VPI exhibited a mean air-bone gap of 15 dB or greater. For the "poorer" ears 18 per cent (41 patients) and 12 per cent (two patients) exhibited a mean air-bone gap of 15 dB or greater for the group with clefts of the palate or VPI, respectively. None of the patients with cleft of the lip only had a mean airbone gap as large as 15 dB.

TABLE 5. Mean air-bone gaps for the "better" ears.

Type of cleft	*frequency*				
	250	500	1000	2000	4000
Lip	4 dB	1	0	1	1
Palate	9	5	3	2	3
VPI	8	6	3	3	3

TABLE 6. Mean air-bone gaps for the "poorer" ears.

Type of cleft	*frequency*				
	250	500	1000	2000	4000
Lip	3 dB	0	0	0	0
Palate	15	11	9	5	8
VPI	12	9	6	6	7

Thirteen per cent (30 patients) of the group with clefts of the palate and 12 per cent (two patients) of the group with VPI exhibited a mean air-bone gap of 5 dB in the "better" ear for the speech frequencies. When the "poorer" ears were considered, 34 per cent (77 patients) of the group with clefts of the palate and 29 per cent (five patients) of the group with VPI exhibited a mean air-bone gap of 5 dB or greater. No patient with a cleft of the lip only had a mean air-bone gap as large as 5 dB.

Physical Management of the Palate. For further analysis of the air-bone gap data, the 227 patients in the cleft of the palate group were divided as done earlier into the four types of palatal clefts. Each of these cleft groups were again divided into the three methods of physical management of the palate. The results of a three-way analysis of variance for the air-bone gap for the "better" ears indicated no significant difference in the extent of air-bone gap among the four cleft types and no significant difference in air-bone gap among the three types of physical management of the palate.

When the air-bone gaps for the "poorer" ears were subjected to a three-way analysis of variance, no significant differences were found among the types of cleft or the methods of physical management of the palate.

The Questionnaire

The questionnaire provided little valuable information, as recall is often difficult. Only 27 per cent of the total patients in this investigation ever reported having hearing problems. Forty-nine per cent reported ear pathologies such as ear aches. Forty-eight per cent

TABLE 7. Percentage of patients who exhibited an air-bone gap in the better ear and the poorer ear for the mean of the speech frequencies (500, 1000, and 2000 Hz).

Extent of air-bone gap	*type of cleft*				*VPI*	
	lip		*palate*			
	better ear	*poorer ear*	*better ear*	*poorer ear*	*better ear*	*poorer ear*
25 dB or more	0%	0%	0%	11%	6%	12%
15 dB or more	0%	0%	6%	18%	12%	12%
5 dB or more	0%	0%	13%	34%	12%	29%

reported taking medication for ear problems, while only 15 per cent reported any operations on the ears. Of those who reported ear operations, more than half were under 24 years of age.

Six patients wore hearing aids. Of those patients, four had conductive losses, one had a sensori-neural loss, and one had a mixed loss (a combination of neural and conductive components). Three of the six hearing-aid users had clefts of the soft palate; one had a cleft of the hard and soft palate; and two had bilateral clefts of the lip and palate. Physical management of the palate for the six with hearing aids included one with palatal surgery only, two with a speech appliance only, and three with surgery plus a speech appliance.

Discussion

Information on otologic care of patients in this investigation is sparse since those who did report such care (medical or surgical) had little further recall of the date, the physician, or the location where such treatment was administered. It is unlikely that these patients received any special otologic care unless acute infection developed. At the time of early childhood for this population, there was generally little or no emphasis placed on the condition of the ears and/or hearing sensitivity of children with cleft palate. Only recently has the universality of middle ear infection in infants with unrepaired clefts been established (Stool and Randall, 1967; Paradise, Bluestone, and Felder, 1969) and agressive otologic treatment programs applied (Paradise and Bluestone, 1974, Donaldson, 1966). Therefore, the data for this investigation may essentially represent individuals who have had minimal otological care for middle ear infections.

The findings of the present study showed that the mean air and bone conduction pure tone thresholds of adults with a cleft of the lip are within what had for many years been generally considered normal limits—25 dB or less*—for the "better" and "poorer" ears. The cleft of the lip apparently does not contribute to middle ear infection and does not interfere with the hearing sensitivity in the adult population (Graham, 1963). Data on hearing sensitivity for individuals with clefts of the lip only should, therefore, be studied separately when investigating the effect of palatal cleft-ing upon hearing.

The mean air conduction pure tone thresholds for individuals with VPI were higher (poorer) than those with clefts of the lip. The thresholds for adults with VPI were not significantly different from those of individuals with clefts of the palate for both the better and poorer ears. Apparently, palatal clefts and VPI contribute similarly to conductive hearing impairment. The necessity for further research into the study of VPI and hearing sensitivity is certainly evident.

The mean air conduction thresholds of adults with clefts of the palate in this study were also higher (poorer) than those with clefts of the lip, but still fell within normal limits when the "better" ears were considered. When the "poorer" ears were considered, the mean thresholds were greater than those for the "better" ears and approached the upper limits of normal hearing. At 8000 Hz the mean thresholds for the "poorer" ears exceeded normal limits. These mean thresholds for individuals with clefts of the palate may be viewed as supporting research by Goetzinger, Brooks, and Proud (1960) which suggest that adults had only a slightly shifted threshold and possessed hearing within the limits of normal.

However, when the number of individuals who exhibited thresholds for the mean of the speech frequencies in excess of normal limits (greater than 25 dB) is considered, it is difficult to view the adult population with clefts of the palate in this study as falling within normal limits. Approximately one-tenth of the individuals exhibited mean thresholds for the speech frequencies in excess of 25 dB for the "better" ear. Approximately one-fourth of the individuals exhibited mean thresholds for the speech frequencies in excess of 25 dB for the "poorer" ear. The incidence of individuals with thresholds in excess of normal limits supports Miller's (1956) suggestion that medical treatment is necessary to eliminate hearing loss in adulthood.

Concerning the frequencies most affected by repeated middle ear infection, the data in the study partially agree with several of those reported previously. There were raised air conduction thresholds at both higher and lower frequencies as reported by Gaines (1940). The poorest thresholds were found at

*Refer to footnote on page 74.

8000 Hz and are in agreement with Miller (1956) that the very high frequencies (8000–12000 Hz) are the most commonly affected. However, when the air-bone gaps are considered, the data in this study support Sataloff and Fraser's (1952) findings that the predominate loss is in the lower frequencies. In other words, the larger air-bone gaps occurred at the lower frequencies. The slightly lowered bone conduction thresholds for the higher frequencies in this study support results reported by English, Northern, and Fria (1973). They found that bone conduction thresholds decrease with the degree and duration of otitis media.

There have been conflicting reports in the literature in relation to the type of palatal cleft and hearing loss. Some investigators (Masters, Bingham, and Robinson, 1960; Spriestersbach, 1962; Heller, Hockberg, and Milano, 1970) reported a higher incidence of hearing loss in individuals with clefts of the hard and soft palate, while others (Sweitzer, Melrose, and Morris, 1968) reported a higher incidence of loss in individuals with a cleft of the lip and palate. This investigation found no significant difference for adults among types of palatal cleft with respect to air conduction hearing sensitivity or the extent of air-bone gap.

There has been conflicting evidence with respect to hearing and the use of a speech appliance. Some investigators (Masters, Bingham, and Robinson, 1960; Spreistersbach, *et al.*, 1962) observed a higher incidence of hearing loss in patients who had been prosthetically managed while other investigators (Anthony, 1967; Graham, Schweiger, and Olin, 1962) reported that prosthetic management was not a detriment to hearing. For the adult patients in this study, no significant differences were found in air conduction thresholds or extent of air-bone gap among those whose palates had been surgically repaired, those who had been fitted with speech appliances, or those who had had combined surgical and prosthetic management.

Summary

This study was designed to investigate the hearing sensitivity of adults with a cleft of the lip and/or palate or velopharyngeal inadequacy (VPI). In addition to age, type of cleft and type of physical management of the palate were taken into account. Hearing sensitivity was analyzed with respect to pure tone air conduction thresholds and the extent of air-bone gap.

The following were concluded from the data gathered in this study:

1. The mean air and bone conduction pure tone thresholds of adults with clefts of the lip fell within what has frequently been considered normal limits (25 dB or better).
2. The mean air conduction pure tone thresholds for adults with clefts of the palate were higher than the mean thresholds for adults with clefts of the lip but fell within normal limits for the "better" ears. The mean thresholds for the "poorer" ears approximated the upper limits for normal hearing with several mean thresholds exceeding normal limits.
3. The mean air conduction thresholds and extent of air-bone gap for the adults with VPI were not significantly different from those of the adults with clefts of the palate.
4. The incidence of hearing loss of adults with clefts of the palate varied according to the criteria set for a hearing loss and whether the "better" or "poorer" ears were considered.
5. For adults with clefts of the palate, ears were most sensitive to air conduction pure tones at the middle frequencies corresponding to the speech frequencies (500, 1000, and 2000 Hz). Higher air conduction thresholds were found at both high and low frequencies. The ears were least sensitive to air conduction at the high frequencies.
6. The largest air-bone gaps for adults with clefts of the palate occurred at the low frequencies.
7. There were no significant differences in air conduction thresholds or extent of air-bone gap among the types of cleft of the palate (1. unilateral cleft of the lip and palate; 2. bilateral cleft of the lip and palate; 3. cleft of the hard and soft palate; and 4. cleft of the soft palate only).
8. There were no significant differences in air conduction thresholds or extent of air-bone gap among the types of physical management of the palate (1. surgery only; 2. surgery and a speech appliance, and 3. speech appliance only).

Acknowledgment: The author wishes to thank Mrs. G. Sullenberger for tabulation of the data, Dr. Joseph Meier and Mr. Harry Can-

ter, Millersville State College, Millersville, Pennsylvania, for the statistical analyses of the data in this investigation, and Dr. Norman Lass, West Virginia University, Morgantown, West Virginia, for his review of the manuscript.

Reprints: *Elca Swigart, Ph.D.*
Lancaster Cleft Palate Clinic
24 N. Lime Street
Lancaster, Pennsylvania 17602

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