Articulation Skills and Oral-Nasal Resonance in Children with Pharyngeal Flaps

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Longitudinal data on *speech sound acquisition* and *oral-nasal balance* were analyzed in 52 children who had had *pharyngeal flaps* for *velopharyngeal incompetency.* These data were compared to similar data for a group of 48 children with *cleft palates* who had not required secondary management. Comparisons were made also between the pre- and post-surgical performance of the group who had had pharyngeal flaps. Further comparisons were made between children who had surgery before six years of age and those who had surgery after six years.

Analysis of data revealed that the children who required pharyngeal flaps lagged behind the group who did not in the development of acceptable resonance and articulation patterns. Further analysis showed that, for the post-pharyngeal flap group, there was an acceleration in the acquisition of acceptable sound production in the year immediately following surgery. The data suggested that children who had flaps before six years of age made faster gains in the development of articulation and acceptable resonance than did children who were treated after the age of six years.

Introduction

Secondary management for velopharyngeal incompetency (VPI) is still required with some frequency for children born with palatal clefts (Morris, 1973). Recently, Riski et al. (1977) reported that 27% of children with palatal clefts in their longitudinal series at the Lancaster Cleft Palate Clinic required secondary management of VPI.

The purpose of a pharyngeal flap is to create a mechanism which is capable of achieving velopharyngeal closure so that normal articulation and appropriate oral-nasal resonance balance may be achieved. Examination of articulation and resonance provide information necessary to rate the effectiveness of the surgical procedure. Therefore; the purpose of this paper is three fold:

1) to examine the effect of chronological age on the development of articulation and resonance,
2) to examine articulation and resonance before and after pharyngeal flap surgery and,
3) to examine the effect of the age at the time of the secondary surgery on articulation and resonance development.

Procedures

SUBJECTS. The longitudinal speech research series at the Lancaster Cleft Palate Clinic was, at the time of this study, composed of 327 children with oral-facial clefts. Of these, 241 had palatal clefts that had been closed surgically. Fifty-two (22%) of the 241 patients with palatal clefts had had superiorly based pharyngeal flaps. Twelve children (5%) had been fitted with prosthetic speech appliances. Thus, 27% of the 241 children had required secondary palatal management for velopharyngeal incompetency (Table 1).

There was not a large difference in the percentages of children requiring secondary procedures among cleft types. Twenty-four (21%) of the 115 children with clefts of the lip and palate had had pharyngeal flaps (CLP-F), and 28 (22%) of those 126 children with clefts of the palate only had had pharyngeal flaps (CP-F). The 52 children represented each sex in approximately equal numbers. There were 25 males and 27 females.

The mean age of the patients at the time of the secondary surgery was 6.43 years (sd = 1.9). The mean age for children with clefts of the lip and palate was 6.46 years

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TABLE 1. The Number of Patients by Type of Cleft for the Pharyngeal Flap and Nonflap Control Group.

	CLP	CP	Totals
FLAP	CLP-F=24	CP-F=28	52
NONFLAP CONTROL	CLP=27	CP=21	48
TOTAL IN SERIES WITH PALATAL CLEFTS	115	126	241

(sd = 2.0), while for children with clefts of the palate only, the mean age was 6.42 (sd = 1.9). The type of cleft, therefore appeared not to influence the age at which the decision to perform surgery was made.

The modal age for surgery was between five and six years. Thirteen children had pharyngeal flap procedures between their fifth and sixth birthdays. By six years of age, 24 (46%), or almost one-half of the children had had flaps. By seven years, 24 (65%), or almost two-thirds, had had flaps. All children had had flaps before eleven years of age.

A control group, comprised of 48 children who had not had pharyngeal flaps, was assembled from the data on the remaining patients in the longitudinal series. The non-flap group was selected to approximate the representation of cleft types and sex in the pharyngeal-flap group. The control group consisted of 27 children with clefts of the lip and palate (CLP) and 21 children with clefts of the palate only (CP). The sex representation in the control group approximated that in the experimental group. The remaining 141 patients, many of whom were too young to have sufficient data for analysis and 12 of whom were wearing prosthetic speech aids, were excluded from the study.

Speech Evaluation. Evaluation of speech and language proficiency was made on each child's birthday (± two weeks) from three years of age through adolescence. Oral-nasal balance was evaluated during conversational speech by one speech pathologist with over twenty-five years of experience in evaluating the speech of children with palatal clefts. A rating of "acceptable" was made when oral-nasal resonance was judged to be within normal limits. A rating of "unacceptable" was made when resonance was considered to be hypernasal. When there was a question of a rating, a second speech pathologist was consulted and an agreement reached. The reliability of these judgements was not measured.

The articulation tests for each child were tape-recorded and evaluated by one of two speech pathologists who had previously demonstrated 98% interjudge agreement for correct-incorrect judgements of speech sound productions (Riski, 1976). For the purposes of this study, each patient's correct responses on the Templin Darley 50-Item Screening Test were extracted for use in the analysis. For portions of the analysis, the scores of the subjects in the study were compared to the mean scores of Templin's (1957) normative sample.

Results

Articulation Development. The study group was divided by cleft type for analyzing articulation development. Twenty-four children with flaps had clefts of the lip and palate (CLP-F), and 28 of the children with flaps had clefts of the palate only (CP-F).

The acquisition of speech sounds for the 24 CLP-F and the 27 CLP children is demonstrated in Figure 1. These two cleft groups are compared to the non-cleft group tested by Templin (1957). The CLP group follow the same curve as the normal, although it was usually a year behind the normal group. The CLP-F children demonstrated a much slower rate of articulation acquisition before the age of six years than did the CLP children. Between six and eight years of age, CLP-F children demonstrated a rapid increase in the acquisition of speech sounds and, as a group, appeared to be "catching up" to the speech proficiency demonstrated by the CLP group.

Similarly, the acquisition of speech sounds for the 28 CP-F and the 21 CP children is demonstrated in Figure 2. Again, the two cleft groups are compared to Templin's non-cleft group.

The CP group followed a curve of sound acquisition similar to that demonstrated by the normals. By eight years of age, the CP group fell within the limits of normal articulation. The CP-F group, however, demonstrated a somewhat slowed rate of sound acquisition prior to five years of age. Between five and eight years, they demonstrated an accelerated rate of sound acquisition.

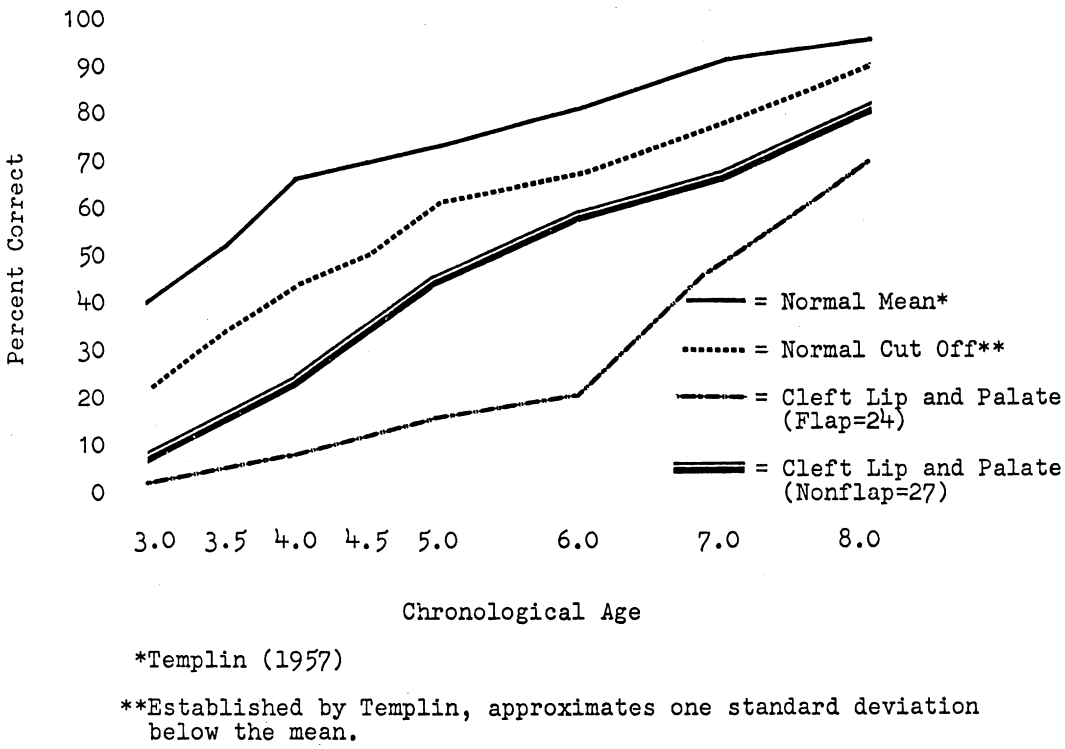

FIGURE 1. Percentage of Sounds Correct on the Templin-Darley 50-Item Screening Test for a Group of Normal Children and Those with Cleft Lip and Palate.

Figure 3 illustrates the cumulative test performance of the 52 patients on the Templin-Darley Screening for the years before and after pharyngeal flap surgery. The immediate effect of the flap on articulation acquisition is clearly visible. In the first year after surgery, the scores of the Templin-Darley 50-Item Screening Test improved 24%. Improvement after the first year was more gradual.

In order to evaluate the effectiveness of pharyngeal-flap surgery as it related to the age at which it was performed, the group of 52 was divided into two subgroups on the basis of age at the time of surgery. One group of 24 children had surgery prior to six years of age. The mean age at the time of surgery was 4.8 years (sd = 1.2). A second group of 28 children had surgery after six years of age. The mean age at the time of surgery was 7.9 years (sd = 1.2). Cleft types were pooled for this analysis. Comparison of the development of articulation proficiency in these two groups, as shown in Figure 4, revealed that the children who had flaps *later* were delayed in developing articulation skills when compared to the group who had flaps earlier.

ORAL–NASAL RESONANCE. Figure 5 illustrates the percentage of children with each type of cleft who had acceptable oral-nasal resonance at each chronological age from three through eleven years of age. Prior to five years, there were relatively few children who had acceptable oral-nasal resonance. These few children were rated as having borderline competency; that is hypernasality was detected by the examiner but was not judged to be sufficient to be heard by the naive or untrained listener. Later, however, these children were judged to require secondary palatal management. A larger percentage of the CLP-F children achieved acceptable resonance by eight years of age than did the CP-F children. At no time prior to eleven years of age, however, did 100% of either group achieve acceptable resonance.

Figure 6 demonstrates the effect of surgery on the development of acceptable oral-nasal resonance. In the presurgical years, there was

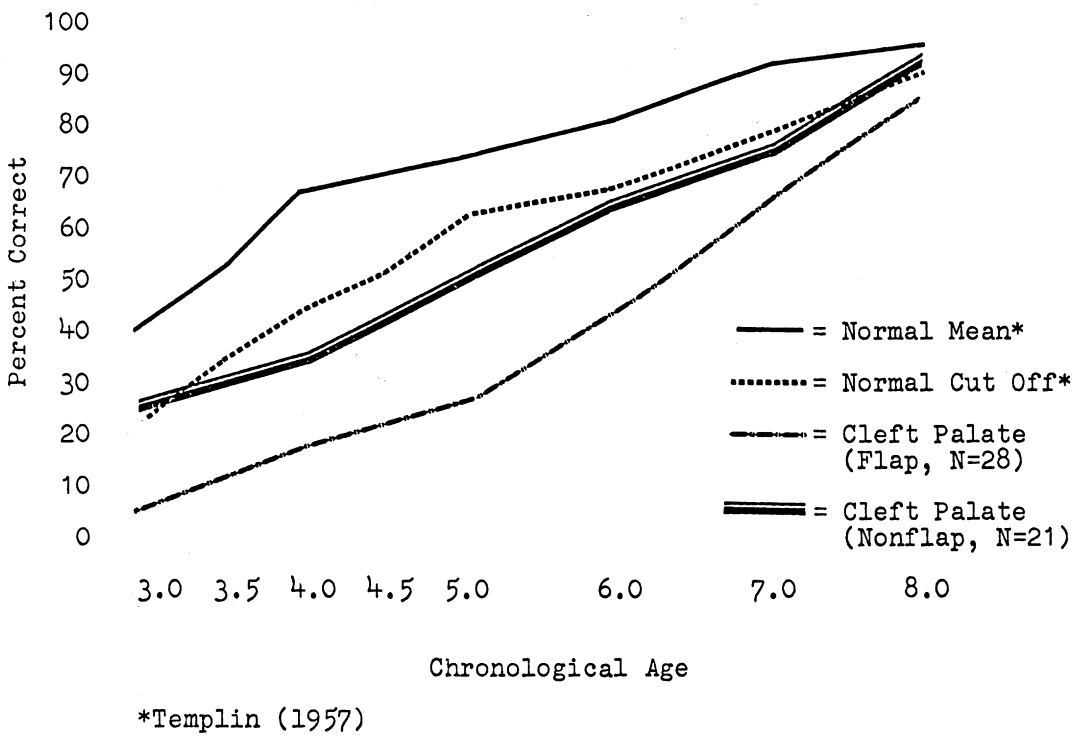

FIGURE 2. Percentage of Sounds Correct on the Templin-Darley 50-Item Screening Test for a Group of Normal Children and Those with Cleft Palate Only.

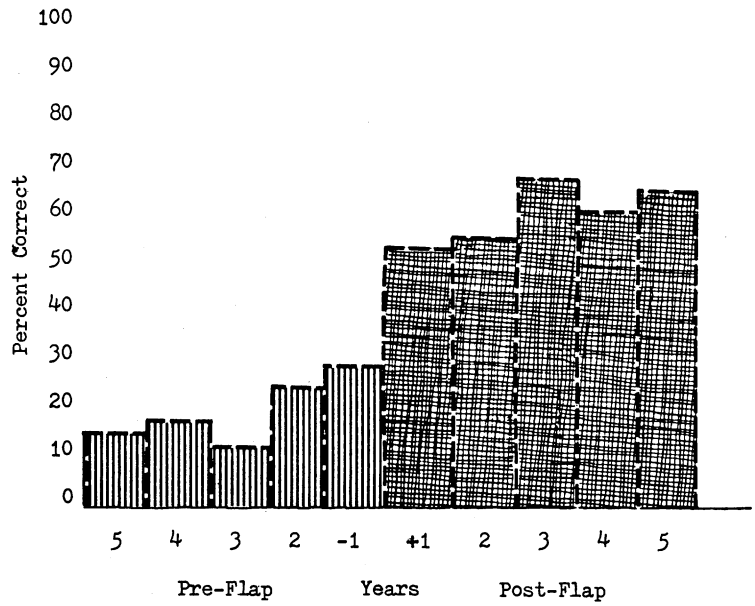

FIGURE 3. Percentage of Sounds Correct on the Templin-Darley 50-Item Screening Pre and Post-Pharyngeal Flap Surgery for Children with Clefts of the Lip and Palate and for Children with Clefts of the Palate Only.

virtually no increase in the number of children rated as having acceptable resonance. In the first year after surgery, however, there was an increase of 35% in ratings of acceptable resonance in the CLP-F group and of 63% in the CP-F group. Lesser increases occurred in the remaining years of follow-up. By the fifth postoperative year, 100% of the CP-F group

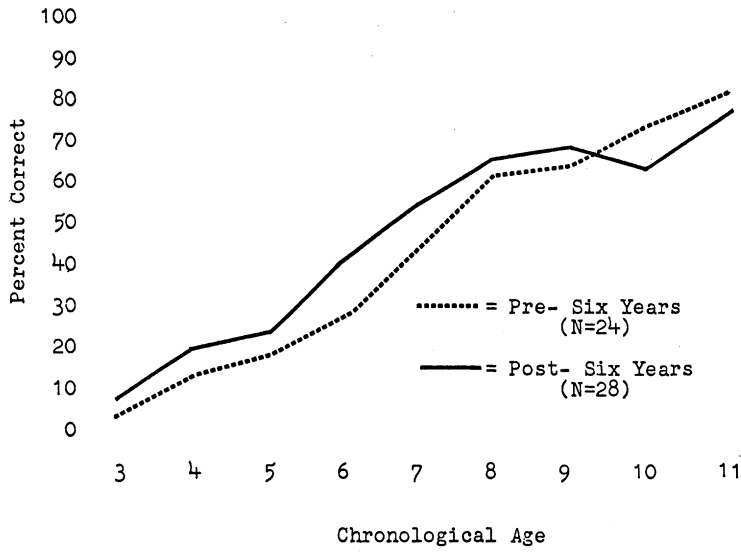

FIGURE 4. Percentage of Sounds Correct on the Templin-Darley 50-Item Screening for the Group of Pharyngeal Flap Patients Who Had Surgery before Six Years of Age and the Group Who Had Surgery after Six Years of Age.

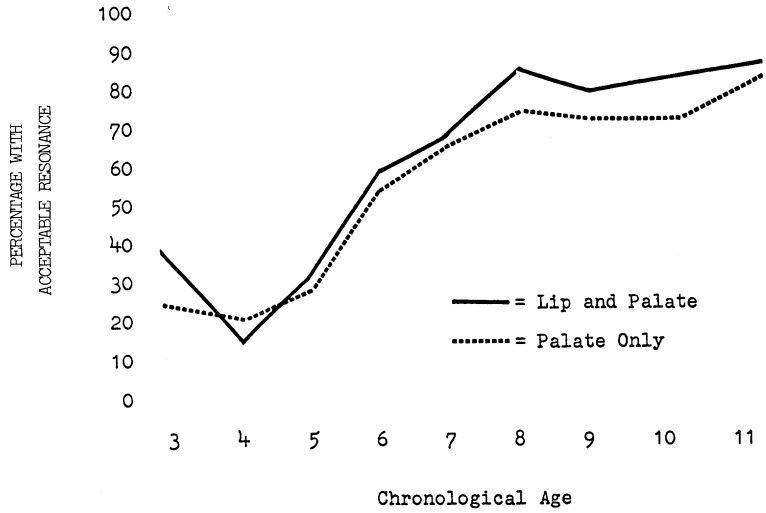

FIGURE 5. Percentage of Patients with Acceptable Oral-Nasal Resonance for Children with Clefts of the Lip and Palate and Children with Clefts of the Palate Only.

had achieved acceptable resonance, and 85% of the CLP-F group demonstrated acceptable resonance.

Figure 7 compares the development of acceptable oral-nasal resonance in children who had had pharyngeal flaps prior to age six with those who had such surgery after age six. The type of clefts were again pooled for this comparison. All of the children who had had flaps prior to six years of age had achieved acceptable oral-nasal resonance by seven years of age. Children followed through eleven years of age had maintained this acceptable quality. However, those children who had had flaps after six years of age were delayed in acquiring acceptable resonance, and approximately 15% had not achieved acceptable resonance at the time of this study.

Discussion

The results of this preliminary analysis suggest that children who required pharyngeal-flap surgery for velopharyngeal incompetency were delayed in the acquisition of speech sounds when compared to similar children who did not require secondary management. Children with clefts of the lip and palate, in general, were more seriously delayed than

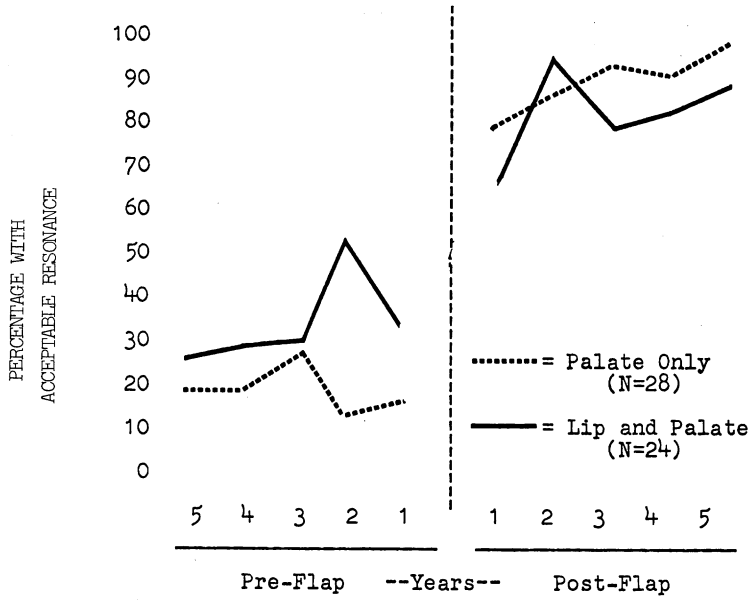

FIGURE 6. The Percentage of Patients with Acceptable Resonance Rated Prior to and following Pharyngeal Flap Surgery.

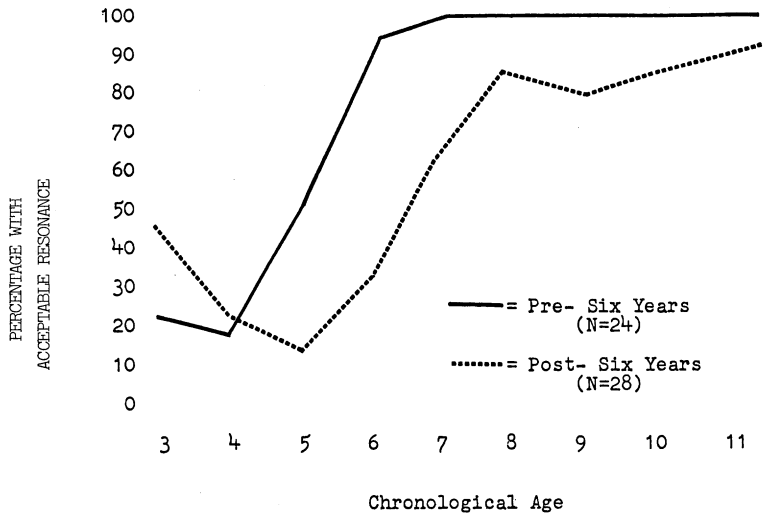

FIGURE 7. The Percentage of Patients with Acceptable Resonance for the Group of Pharyngeal Flap Patients Who Had Surgery before Six Years of Age and for the Group Who Had Surgery after Six Years of Age.

were children with clefts of the palate only. However, all groups of subjects demonstrated accelerated acquisition of speech sounds between six and eight years. This more than likely reflects the fact that 77% of all patients had pharyngeal flaps by eight years of age. The greatest gain in acceptable resonance appeared within the first year post-surgically. In this regard, the CP-F group made greater gains than did the CLP-F group.

Yules and Chase (1971) presented a literature review on pharyngeal flap surgery. The reports reviewed included the superiorly or inferiorly based flap or the flap in combination with a push-back procedure. There was a failure rate no greater than 29% in all but one study. In most studies, however, the criteria used for determining success was unclear. In this study, 92% of the children were rated as having "acceptable" oral-nasal resonance two years post-operatively, a failure rate of 8%. The percentage of patients with

"acceptable" resonance remained consistent five years post-operatively.

Children who were treated earlier than six years of age by pharyngeal flap surgery made gains in articulation acquisition earlier than did those who were treated later. These findings are in general accord with those of Moran (1951) and Moll et al. (1963). Both studies reported that the relative incidence of normal speech was lower for patients who had pharyngeal flaps after 15 years of age. The children in this study who had flaps earlier than six years of age also made earlier gains in achieving "acceptable" resonance. One hundred percent of the children in this group had achieved "acceptable" resonance by seven years of age.

It is some concern that, even with secondary management, we are not able to establish acceptable articulation and oral-nasal resonance in all our patients. It may be that, by the time of secondary management, maladaptive articularly patterns are so well entrenched that they are resistant to all but the most intensive therapeutic management. It is possible also that the severity of the structural malformations precludes the development of acceptable speech and resonance. The flaps may have been inadequate in width or placed inappropriately. Although pre-operative cineradiographic studies were taken, post-operative studies were not. Post-operative cineradiographic and fiberoptic studies would have yielded important additional information about the acceptability of flap position and width.

The work recently completed by Fletcher (1978) also suggests that speech development is enhanced by early surgery. Although Fletcher dealt with primary surgery, there are many similarities between his patient populations and the one reported here. Fletcher found that children who had had primary surgery early had better articulation, resonance, and intelligibility than did children whose surgery was delayed. Fletcher cited several hypotheses that might explain the results. A psychosocial hypothesis suggests that early surgery allows a family to establish confidence earlier and thus family energies can be directed at aiding the child to develop speech skills. The second pertinent hypothesis suggests that early surgery results in less severe and less permanent maladaptations in speech physiology. Fletcher suggested further that articulation movements and posture are more malleable at earlier ages and that adaptations to the newly created oral environment should, therefore, make therapy easier.

There are a number of design limitations in a longitudinal clinical study. An ideal design would have allowed for the comparison of speech development in two groups, one with VPI treated by pharyngeal flaps and the other with VPI untreated. In a clinical program it is ethically impossible to defer management in cases where intervention is clearly indicated. We are left, therefore, with a pre-post-treatment design.

The data were analyzed approximately thirteen years after the first data were collected. It is difficult in such a design to incorporate scientific research innovations without revamping the original protocol and destroying the usefulness of some data previously collected. It would be very useful to incorporate sentence articulation tests (Van Demark, 1971), pressure-flow measurements (Warren, 1975), and sound-pressure level ratios between the oral and nasal cavities (Fletcher, 1969). More information might be obtained by analyzing the types of articulation errors rather than simply counting the number of correct responses. This is particularly important when it is remembered that articulation errors may be present for many reasons, only one of which is velopharyngeal incompetance. To this end, programs are being developed to allow an indepth item-error analysis.

Stricter interjudge reliability stipulations might have been imposed. However, since one experienced and qualified speech pathologist rated oral-nasal resonance in each case, we can suppose that any error would be consistent. Further, judgements made on a dichotomous scale ("acceptable"-"unacceptable") such as used here generally yield high agreement reliability, although the system tends to obscure borderline data.

Despite the limitations, there is a good deal of information contained in the articulatory responses of these patients. Articulation scores from the Iowa Pressure Articulation Test have been demonstrated to be a good predictor of the need for secondary management (Van Demark and Morris, 1977). These differences

can first be observed in the scores at three to four years of age. Our results suggest that there is still a need to identify these children earlier in order to establish an intact velopharyngeal valving mechanism as early as possible. It is sometimes difficult to test articulation formally and to obtain radiographic assessments of children prior to three or four years of age. Cooperation and responsiveness may be limiting factors.

Predictors, either singularly or in a battery, must be identified so that they can be utilized prior to this age. Morphological measurements of the velopharyngeal structures as used by Mazaheri et al. (1976), parents' reports of vocalization, or clinical observations of speech patterns and oral-nasal resonance made by speech pathologists may provide information about the status of the velopharyngeal valving mechanism and permit the prediction of future velopharyngeal competency.

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