

# Velopharyngeal Competence and Primary Cleft Palate Surgery, 1960-1971: A Critical Review

HUGHLETT L. MORRIS, Ph.D.

*Iowa City, Iowa 52240*

The question of which type of palatal surgery procedure yields the best results in velopharyngeal status has been a problem to many workers in cleft palate. Research of this kind is very difficult to do and, as indicated by Grabb (4), we do not have much data about the matter. The purpose of this paper is to present a critical review of the literature since 1960 and to present a discussion of some theoretical considerations to be made in doing such research. In a later paper (12), a project is described in which an attempt was made to take into account some of these theoretical considerations.

## Review of the Literature Since 1960

Greene (5) reported the results of the Wardill-Kilner V-Y retropositioning procedure used for 153 cleft palate patients who had received all their treatment at the Stokes Mandeville Plastic Clinic. Lip surgery was performed at three months and palate surgery was performed at one year. We are not told in the report the number of surgeons involved in the series (presumably several were), nor are we told the age at which the patients were examined for the project in question. In addition, apparently two speech clinicians (the author and one other) took part in the assessment procedures and we do not know how well they agreed with each other about judgments involved in the collection of data.

There is some confusion in Greene's report about her methods of assessment. She describes several techniques for assessing adequacy of nasopharyngeal closure (the presence of moisture on a cold mirror held near the nostrils, the degree to which the patient can blow a carnival blower, a kind of water manometer, and lateral head X-ray films) but apparently her major criteria had to do with speech production. She used speech sound articulation as one criterion and, apparently, degree of nasality as the other criterion. Although nasality is usually regarded as a resonance trait which occurs during vowels, she includes also under that heading the parameter of "audible nasal escape". The phenomenon of nasal escape is generally considered to involve direction of air flow during consonant

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Dr. Morris is Professor of Speech Pathology, The University of Iowa, Iowa City, Iowa.

articulation, and so in assessing that aspect she was considering mainly the adequacy of the articulation of consonants.

She is very clear about one thing, in that regard, and it is that she was concerned in her assessment of speech only about what she called "nasal stigmata". We can take that to mean that she disregarded errors of articulation such as distortions of /r/ and /l/ which are not related to direction of air flow or nasal resonance (and hence velopharyngeal adequacy).

The results she reported are somewhat contradictory. She divided her group into three cleft types and reported results for each: normal speech always or lateral articulation only (a nonvelopharyngeal problem) for 86.7% of 83 unilateral lip and palate subjects, 79.5% of 39 bilateral lip and palate subjects, and 35.5% of 31 post alveolar cleft palate subjects. Apparently she was very uneasy with the last figure (for the post alveolar cleft palate group) and indeed wrote that "the number of patients with nasal articulation [in the post alveolar group] is not representative of the effectiveness of the Wardill-Kilner procedure".

McWilliams (9) reported some data about the speech results of British cleft palate surgery. She examined "some 60" patients in various British centers, and reported specific data about 45 children. The 45 children had a mean age of 7 years, 3 months at the time of her examination. The mean age at cleft palate surgery for the group was 16.4 months although, apparently, if there was cleft lip, "the anterior palate [was] repaired at the time the lip was done". Apparently 8 surgeons did the surgery, using "some modification of the Veau—particularly the Kilner and Braithwaite versions of the Wardill adaptation".

Three methods for evaluation were used: speech ratings, consonant articulation proficiency, and oral breath pressure (manometer) ratios. Speech ratings were made by McWilliams, the child's mother, and the speech therapist (from the specific center), when available.

A five-point rating scale was used; these are the results of her ratings: excellent or completely normal (33% of the group); good (47%); average, for cleft palate (4%); poor (9%); and very poor (7%). She reports correlation coefficients regarding the relationships among the ratings: McWilliams versus the mother, .81; and McWilliams versus the speech therapist, .98.

Some information is reported about the articulation skills of the British children. For example, when they showed articulation errors, the errors were usually distortions of the /s/ and /z/ so mild in extent that they would not be detected by the untrained listener. She did not report whether these distortions were oral or nasal in character. (It was noted that there are some apparent differences between the British and American standard /s/ and /z/.) When she compared articulation skills of the British children with skills of a group of American children, the British children had superior articulation. However, no significant difference was

found when she considered only those British and American children who had had palatal surgery before the age of two years.

Every one of the 45 British children showed no difference in the manometer readings taken with nostrils open and nostrils occluded. She interpreted that finding as one more indicator that the children had velopharyngeal competence, which was also reflected in their verbal output.

Holdsworth (6) presents data from a series of his own of 85 patients for whom he had used the Langenbeck procedure. It is not clear how old the patients were when he examined them, nor is it clear whether he personally evaluated the results or whether other people were involved. The criterion used was whether the speech seemed normal. He did not present data for the entire group but rather for subgroups, according to age at surgery. His best results were obtained for the subgroup who received repair between 6 to 9 months (77% of the 16 subjects in that subgroup had speech that was apparently normal) and his poorest results were obtained for the subgroup who had surgery at ages older than two years (none of the 10 subjects in that subgroup had normal speech). There was a gradual decrease in the percentage with normal speech from early surgery to late surgery and he concludes that it is crucial to perform palate surgery at an early age for best speech results.

Braithwaite (2) and Morley (11) have reported results for 360 children with cleft lip and palate, cleft palate only, and submucous cleft palate who had had the V-Y procedure. The subjects ranged in age at time of surgery from 8 months to 11 years; 65% of the group had surgery between the ages of 1 and 2 years. Braithwaite did all the surgery; apparently the results were assessed by several speech therapists. The children were examined regularly after surgery; at final examination (1968), the subjects ranged in age 7 to 21 years. According to the 1970 report, 95.8% demonstrated nasopharyngeal closure; an additional 2.5% had closure but showed "...some inco-ordination during speech". Vocal tone and resonance were normal in 94% of the group and were nasal in 6%. At final examination, 71% had good articulation and 29% needed speech therapy.

Trauner and Trauner (15) reported results on 264 patients, all of whom had had the V-Y procedure. It is not clear from the report who assessed the speech, what criteria the examiners used, or how old the subjects were. These authors reported that 86% of the group had normal speech with no "rhinolalia aperta". 7% of the group needed pharyngoplasty.

Battle (1) reported results for 413 children who had had the V-Y procedure. He performed surgery for all but three of the subjects. Surgery was performed before the children were 2 years of age; the majority of them were only one year old. The results of surgery were assessed by Battle and confirmed by a colleague or often by a speech therapist. The children were asked to blow and judgments were made about the adequacy of a prolonged *eeee* and other speech sounds. He mentioned in the report the necessity for being alert for pharyngeal fricatives, the lateral

/s/, and glottal stops. No information was provided about age at which the children were examined.

He divided the group into four subgroups, according to cleft type. Best results were obtained for what he called "short post alveolar clefts" (including submucous clefts with bifid uvula) and unilateral clefts, complete. 83% of both of these groups had good speech results. 74% and 70% of the "long post alveolar clefts" and bilateral complete clefts groups, respectively, had good speech results.

Palmer and associates (13) and Lindsay (7) reported data for comparison of two groups of children: 66 children with the Langenbeck procedure and 45 children with the Dorrance Pushback procedure. Presumably, Dr. Hamlen, a speech therapist, did the evaluating. It is not reported who did the surgery. Clinical speech pathology judgments were used as the basis for the decision about adequacy of the surgical results and only speech defects judged to be related to the cleft palate were considered in the evaluation. The authors report that 83% of the Langenbeck group (55 of the 66) had acceptable speech (no "defects . . . directly related to cleft palate") or a speech problem suitable for speech therapy, while only 73% of the Dorrance Pushback group (33 of the 45) met those criteria. A large number of children in each of the two groups was younger than 6 years old at the time of the examination, however.

Millard and associates (10) reported results for 59 children who had the palatal island flap as a primary procedure. (Millard has a series of approximately 200 patients with this procedure used as a primary or secondary procedure but many of them were not available for follow-up.) A speech pathologist and two surgeons (other than Millard) did the evaluations. The evaluations apparently included observations about normalcy of speech, presence or absence of audible nasal escape, and "misting" of a mirror held to the nostrils during the production of a sustained ssss and eeee. Based on those observations, the speech was judged to be normal or to show slight, moderate, or gross nasal escape. He considered the slight nasal escape category to be associated with speech which would be regarded as normal by most surgeons and by the lay public. Special attention was given to the presence of a fistula.

Of the 59 patients, 47 (79.6%) had normal speech or had slight nasal emission. Apparently there were some patients with a fistula (although none of the last 20 patients operated had one). In the patients who had a fistula, the fistula was not judged to have an effect on the speech results (presumably he meant velopharyngeal competence).

McEvitt (8) reported results for 439 patients who had either the Langenbeck, the V-Y, or a "setback and closure" procedure. (The setback procedure appears to be somewhat comparable to the Dorrance pushback.) Evaluations were apparently made by speech pathologists. Judgments were made about whether the speech was normal (essentially a two-point either-or scale). Age at surgery is not reported. Nor does he

define the specific criteria for deciding which patient would receive which procedure, although in one passage he states that the V-Y was used on less difficult cases and the setback was used on the more severe cases. Overall, 23% (of the 439) had "persistent rhinolalia". Differences were found between surgical procedures, but those differences must be interpreted in terms of case selection.

Stark and Frileck (14) reported results for 32 patients who had palatoplasty with primary pharyngeal flap. The surgery was performed in each case at the age of one year and the subjects were at least five years old when the subjects were evaluated. No information is reported about how the 32 patients were selected. Evaluations on all 32 patients were made by one speech pathologist. In the evaluations, language and voice-articulation characteristics were rated on a 5-point scale, ranging from excellent to unintelligible. The ratings were apparently made on several occasions for each patient and were based on observations about volume, pitch, voice quality, rate, rhythm, and articulation. Of the 32 patients, 3 received ratings of excellent and 26 received ratings of good.

Calnan (3) reports results for 245 patients who had the V-Y procedure. Mean age at surgery was 13.4 months. Presumably all surgery was performed by him. He describes the sample of subjects as a consecutive series and so there is apparently no bias in selection. Speech was assessed by "an independent and trained observer". Two criteria were used to define success: 64.1% had "no escape of air down the nose" and 75.5% had "normal articulation". Calnan attributed the discrepancy between the two figures to the fact that minor amounts of nasal escape of air have no perceptible influence on articulation proficiency (an explanation that sounds entirely reasonable).

## Discussion

Although there is considerable variance in the findings and although there are some serious methodological problems in the procedures used in the projects, it seems likely that, in general, 75% of the patients who receive primary palate surgery demonstrate velopharyngeal competence. That figure should be regarded as tentative, of course, and may certainly need to be revised as more data become available.

As is evident from the review just presented, there are many limitations to the data now available. Some of the limitations are the results of some very real design problems in doing this kind of research and other limitations are the result of the lack of precision on the part of the investigator.

**SPECIFYING THE POPULATION AND THE SAMPLE.** One major problem is attempting to specify the population from which the sample to be studied is taken and attempting to select a *random* sample from that population. If the objective is to evaluate the effects of a surgical procedure on the "typical" cleft palate, then the investigator needs to be sure that the procedure in question was used for every patient with cleft palate during

the period of time under consideration. For example, if very severe cleft palates were not operated, but were obturated, then the population of cleft palate patients being studied must be specifically limited in that way and the report must reflect that limitation.

Attempting to select a random sample from the population is also crucial. The investigator needs to take every possible precaution to avoid selecting a preponderance of patients with good results for study. Furthermore, it is not enough to assume that the reader knows he has done that; he needs to demonstrate to the reader that he has. Calnan (3) was demonstrating his intent to study a random sample when he reported that he evaluated results for a *consecutive* series.

The matter of random sampling is especially crucial when the objective of the project is to compare the relative effectiveness of two (or more) procedures. The data reported by McEvitt (8) is an example of this kind of problem. Although McEvitt has data from three procedures, comparisons of them cannot be made because at least two of the three (the V-Y and the setback) were used selectively and not randomly. Therefore, the only inference possible from his data is that better results are obtained with the V-Y than with the setback when the V-Y is used with less severe clefts and the setback is used with the more severe clefts. In that case, it is impossible to say whether the differential in results is a reflection of the procedure used or of cleft type.

The reports by Palmer and associates (13) and Lindsay (7)—apparently the two reports are about the same project—raise the same kind of question. In neither of the two reports is there information about the criteria used in deciding which patients received which of the two procedures. It may be that two consecutive series were used for the comparison. If that is the case, the authors should have made clear statements to that effect in the reports.

There is a moral issue to be considered in designing research for the comparison of two or more surgical procedures (or any other health-related procedures administered to humans). That issue is the question of whether, in the surgeon's opinion, all procedures under consideration are likely to give equally good results. If, in his professional opinion, procedure A is more likely to give better results than procedure B, it would be difficult to justify the use of procedure B, even if it were for the purposes of learning more about the two procedures. Millard and associates (10) recognized this problem when they wrote: "The senior author's faith in the principle of closing raw areas ruled out the possibility of controls" (p. 540). This moral issue poses some serious limitations on the feasibility of certain types of clinical research and is one that must never be considered lightly.

**SELECTING METHODS FOR ASSESSMENT.** A second major problem in this kind of research is the selection of methods for assessment of results. To begin with, the "speech" results are not the only results that need to be

considered in the evaluation of the effectiveness of a procedure for palatal surgery (or management). There is much evidence that indicates that palatal surgery may also have an effect on the growth of the face. There is also the feeling among clinicians that lip surgery may affect the growth of the midface so that parameter may need to be considered, too.

To return to assessing the "speech" results, there are two underlying premises that apparently need reviewing:

a) Palatal surgery is provided for the purpose of restoring normal palatopharyngeal function. The reason for restoring that function is to enable the patient to articulate consonant speech sounds in a normally oral manner and to achieve a normal balance of oral-nasal resonance.

Therefore, to assess specifically the adequacy of palatal surgery, techniques must be used which reflect velopharyngeal competence (or the absence thereof) during speech without, insofar as possible, the influence of other variables.

Greene (5) tried to do that when she used several techniques for assessing nasopharyngeal closure. McWilliams (9) used oral manometer ratios for that purpose. Morley (11) described her results in terms of nasopharyngeal closure. Trauner and Trauner (15) were less than satisfactorily precise when they used a criterion of "no rhinolalia aperta". Battle (1) was quite vague about his criteria. Palmer and associates (13) were also vague. They specified that only speech defects judged to be related to cleft palate were considered but they included in the success group children with a speech problem "suitable for speech therapy". Millard and associates (10) apparently noted whether there was audible nasal escape during speech as well as nasal escape reflected by misting on a cold mirror, which he considered to possibly reflect a degree of nasal escape which was not audible during speech. Calnan's judgments were based on whether there was "escape of air down the nose" (3).

The second premise follows.

b) For some purposes, the interest may be in determining the possible effect of palatal surgery on the many aspects of speech and language. That is a legitimate research objective, but when a researcher sets about to do that, he is assessing the effectiveness of many other possible influences on speech than just velopharyngeal competence.

When McWilliams (9) used speech ratings and consonant articulation proficiency as part of her criteria, she was assessing aspects of speech in addition to velopharyngeal competence. Holdsworth (6) did that when he required that the speech must seem normal. Battle (1) did that when he based his decisions on adequacy of certain speech sounds. (In that regard, Battle very correctly noted that pharyngeal fricatives and glottal stops are typical of cleft palate speech. The problem is that though these two articulation movements are learned as compensations for velopharyngeal incompetence, they may be continued to be used long after the patient can achieve velopharyngeal competence, just because of learning!) As indi-

cated above, Palmer and associates (13) were assessing speech traits not influenced by velopharyngeal incompetence when they included in their success group patients who had a problem suitable for speech therapy. McEvitt (8) was surely assessing many factors when he required that, to qualify for success, his patients must have "normal" speech. The assessments made for the Stark and Frileck study (14) included many speech traits not directly related to the physiological success of cleft palate surgery: volume, pitch, rate, rhythm, and, to some extent, articulation.

As many writers have pointed out so clearly, there is to date no single measure of velopharyngeal competency that is wholly adequate for predicting success in speech. Each of the many measures that we have (blowing tasks, articulation tests, X-ray films, measures of air flow and air pressure, measures of sound pressure, ultrasonic devices, etc.) has such limitations that the only logical way to proceed, at this point in time, is with a combination of procedures. (Even with a combination of procedures, perhaps the only really final test is how the patient responds to speech therapy!)

Because a combination of procedures is involved and because special training is needed to evaluate the various aspects of speech presented by these patients, a qualified speech pathologist is needed for the job. Certainly any professional worker (or any layman, for that matter) is competent to distinguish between normal and deviant speech, but when the judgment includes some decisions about the *nature* of the deviancies, the services of a professional speech pathologist is required.

Methodologically, the report by Calnan (3) is probably the best. He makes it very clear that the criteria used to evaluate the "speech" results had to do with velopharyngeal competence. In addition, the assessments were conducted by a speech pathologist. The Braithwaite-Morley data seem quite good, even though interpretation of the findings would be facilitated by additional information about age at surgery and age at examination. There is no mention by either Braithwaite or by Morley in their reports about whether obturators were used for any of the population at the time the series was run. Recent information,<sup>1</sup> however, indicates that obturators were not being used as primary management at that center when the series of 360 subjects was studied, and so presumably the 360 subjects constitute a random sample of the population of cleft palate patients treated at that center at that time. The percentage of subjects with nasopharyngeal closure from the Braithwaite-Morley investigation is so high (98%) that it is almost unbelievable. These are highly reputable people, however, and so it is difficult to question their data.

**CONCLUDING REMARKS.** It is quite apparent from the findings above that we have not had the last word in estimating the success of palate surgery in providing an adequate physiologic basis for normal speech.

<sup>1</sup> Personal communication from Dr. Morley.



More data are needed. However, except in very unusual circumstances, the data should not be based on observations from *clinical records*. Clearly, there is simply too much variability and ambiguity in the majority of clinical records for generalizations about palate surgery results to be made. For example, it may not be possible from clinical records to specify the criteria used in the assessments and to insure that the same criteria are used throughout. In addition, it may be very difficult to adequately describe the population and to defend the notion that the sample under study is selected without bias from that population.

It is possible with certain precautions to use clinical populations (in contrast to clinical records) for such research purposes. If that is the case, however, the researcher must be able to demonstrate that he can describe the population and select the sample in a satisfactory manner. In addition he must be able to demonstrate the reliability of the assessment procedures. In a separate paper (12), I have reported a project in which I attempted to meet those requirements.

### Summary

A critical review is provided of published research reports about the "speech" results from primary cleft palate surgery. Some theoretical considerations about the design and conduct of such research projects are discussed. A success rate of 75% seems reasonable in estimating the velopharyngeal competence results from primary cleft palate surgery, although it is apparent that the success rate is influenced by many factors, some of which are not yet identified. There is a great need for additional data about the problem but, to be maximally valuable, future projects must be carefully designed and not merely based on an accumulation of clinical records.

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reprints: *Hughlett L. Morris, Ph.D.*

*Department of Otolaryngology  
and Maxillofacial Surgery  
The University of Iowa  
Iowa City, Iowa 52240*

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