Stability of Velopharyngeal Competency

D. R. VAN DEMARK, Ph.D.
H. L. MORRIS, Ph.D.
Iowa City, Iowa 52242

Numerous methods have been and continue to be used to assess velopharyngeal competency, it being generally assumed that there is no one measure which is totally adequate to make velopharyngeal competency assessments (Shelton, R. L. and Trier, W. C., 1976, and McWilliams, B. J., et al., 1981). Thus, in the clinical situation a combination of methods typically has been used. Often management decisions are made on the basis of what a subject or patient is doing at the time of evaluation and little information may be available about the consistency of the subject or the stability of the velopharyngeal mechanism over a period of several years.

In 1977, Kuehn, Van Demark and Oakes produced a film concerning longitudinal observations of cinefluorographic data of individuals with cleft palate. During the preparation of the film, we were impressed with the variability in velopharyngeal function exhibited within the same individual. In our search of the literature reviewing the stability of the velopharyngeal mechanism, only the study by Mason and Warren (1980) would indicate that there are some individuals who in fact may not have a stable mechanism. These authors attributed the variation in closure to adenoid atrophy.

Since it has been demonstrated (Kuehn and Van Demark, 1976) that radiological information can be reliably interpreted and that perceptual ratings of the adequacy of the mechanism can also be reliably judged, (Morris, 1978) the following investigation was initiated to describe the stability of velopharyngeal function and the articulation of subjects with cleft palate on a longitudinal basis.

The authors are affiliated with the Department of Otolaryngology-Head and Neck Surgery, and Speech Pathology and Audiology, University of Iowa, Iowa City, Iowa 52242. This paper is based on a presentation of the 1981 American Cleft Palate Association Annual Meeting, Denver, Colorado, April 21, 1982. This research was supported in part by Grant X-605, National Institute of Dental Research. Address correspondence to Department of Otolaryngology, University Hospitals, Iowa City, Iowa 52242.

Sample

All subjects were required to have at least three ratings of the velopharyngeal mechanism between the ages of 3½ and 6 years of age as well as at least one articulation test (Iowa Pressure Articulation Test (IPAT), during that period. Subjects were also required to have a velopharyngeal competency rating and articulation test at 10 years of age or older. Subjects who were obturated from 3½ to 6 years of age, or who did not have at least three clinical ratings before secondary management (pharyngeal flap) were excluded from the study. There were 131 subjects who met the above criteria.

Method

Clinical ratings of velopharyngeal competency were made by the speech pathologist who evaluated subjects at intervals of six months before five years of age and at 12 months thereafter. A rating of *one* indicated velopharyngeal competency, a rating of *two* indicated marginal closure, and a rating of *three* indicated no velopharyngeal competency. These ratings were a composite measure of the speech pathologist's best estimate of the mechanism at the time of clinical observation.

The clinical ratings of velopharyngeal closure were averaged for each subject between the ages of 3½ to 6. A rating of 1.0 to 1.3 was considered competent closure. A rating of 1.4 to 2.5 was considered as marginal closure and a rating of 2.6 to 3.0 was considered incompetent. The 131 subjects selected in this man-

ner were grouped into the following categories as based on their closure ratings: 51 subjects closure (VPC), 50 subjects marginal closure (MVPC) and 30 subjects no closure (VPI). Table 1 demonstrates the mean age of surgery for each group as well as type of cleft. As expected, more females than males exhibited cleft of the palate only, while the converse was true for unilateral and bilateral clefts.

Results

For the total sample of subjects, articulation skills improved until approximately 13 years of age and then levelled off with about 85% correct articulation on the IPAT. The number of subjects in some of the older ages is relatively small, and the findings at these ages may not be representative. By inspection, there seems to be no difference among the three closure groups after age 12. However, before that time it is clearly evident that subjects with better velopharyngeal closure achieved better articulation (see Table 2). This relationship is not surprising since articulation testing was one of the clinical procedures used to determine velopharyngeal competency.

For the 51 subjects in the closure group, data about competency status over the time studied are shown in Table 2. There appears to be a trend that as a group, subjects showed a decrease in velopharyngeal competency after age seven with a gradual leveling off at around age 11. It is interesting to note that only one subject was considered as exhibiting marginal velopharyngeal closure at age six; however, by the age of ten, 26.5% of the subjects were rated as exhibiting a marginal mechanism.

In the closure group, two subjects have exhibited enough nasality with some nasal emission that they have received secondary management using a Teflon injection. This

TABLE 1. Sample Classification of Velopharyngeal Competency, with Age of Surgery, Type of Cleft and Age of Last Test

	VPC *N = 51*	*MVPC* *N = 50*	*VIP* *N = 30*
Mean age at surgery (years-months)	2-4	2-4	2-6
Cleft Type = %			
Soft palate only	12	6	3
hard & soft palate	20	24	6
unil. lip-palate	56	45	54
bil. lip-palate	12	25	37
Mean age of last test (years-months)	13-2	13-5	13-11

TABLE 2. Mean Articulation Scores (IPAT in Percent) and Mean Competency Ratings are Presented for the Three Closure Groups. For the Competency and Marginal Groups Data are Excluded After Secondary Management. For the VPI Group, Data Include Secondary Management Since 28 of 30 Subjects had Management. In the Third Column Mean Ratings of Severity of Articulation Defectiveness, (Using a Seven-Point Scale with Seven Most Severe and One Normal), are Presented for the Three Closure Groups. In the Final Column Severity Ratings of Nasality are Presented Using the Same Seven-Point-Scale for the Three Closure Groups.

Age	*Articulation Scores*			*Competency Ratings*			*Articulation Ratings*			*Nasality Ratings*		
	VPC	*MVPC*	*VPI*	*VPC*	*MVPC*	*VPI*	*VPC*	*MVPC*	*VPI*	*VPC*	*MVPC*	*VPI*
3				1.4	2.0	3.0	3.5	4.3	6.1	4.9	5.4	6.5
3½				1.2	2.1	2.9	2.5	4.4	5.7	4.0	5.3	5.5
4	37.1	25.0	2.9	1.1	1.9	2.8	2.0	4.0	6.0	3.9	4.9	6.1
4½	48.8	27.8	7.8	1.1	1.7	2.6	1.9	3.4	5.7	3.5	4.6	5.9
5	50.8	35.5	16.7	1.0	1.7	2.4	1.7	3.1	4.0	3.4	4.2	5.4
6	62.4	45.5	27.1	1.0	1.7	2.0	1.3	2.8	3.9	2.7	3.6	4.6
7	67.9	53.4	44.7	1.0	1.7	1.3	1.3	2.4	2.3	2.5	3.3	3.8
8	71.2	64.3	52.7	1.1	1.4	1.4	1.4	2.1	2.1	2.1	2.9	3.5
9	74.7	67.1	58.6	1.1	1.4	1.3	1.3	1.8	1.7	2.1	2.6	3.4
10	80.9	70.5	68.1	1.2	1.3	1.2	1.5	1.9	1.4	1.8	2.2	2.4
11	79.5	52.1	72.3	1.3	1.2	1.1	1.8	2.0	1.4	1.9	2.4	2.5
12	82.1	79.8	76.6	1.5	1.4	1.1	1.6	2.0	1.8	1.6	2.0	2.2
13	86.2	73.6	83.0	1.2	1.4	1.0	1.5	2.0	1.4	1.5	2.0	1.8
14	85.3	80.1	78.6	1.2	1.4	1.1	1.4	1.6	1.0	1.6	1.9	2.1
15	84.9	88.3	78.4	1.2	1.4	1.0	1.6	1.8	1.7	1.5	1.6	2.4
16	79.0	84.6	78.7	1.3	1.5	1.1	1.3	1.5	1.3	1.8	1.7	2.1

group, however, decreased in severity ratings of nasality (using a seven-point rating scale) as age increased. The same is true for severity ratings of articulation defectiveness (see Table 2).

In summary it appears to us that the subjects who are diagnosed as exhibiting velopharyngeal competency over a period of time, for example from ages 3½ to 6 years, are in fact quite likely to continue to exhibit velopharyngeal competency. Most subjects will remain fairly constant over their treatment period; while others may show some variation in their adequacy.

For the marginal group, the articulation of this group was generally not as good as the closure group during young ages, but became highly comparable to the closure group by age 12.

As the term marginal implies, this group presents difficult management decisions. We wanted to determine if there was some evidence which would predict which subjects would in time need additional management by looking at the data retrospectively. Our results indicated that of the 50 marginal subjects, 30% subsequently had secondary management (N=15). Unfortunately for this group of subjects examination of our data did not provide us with many clues as to why these particular subjects had secondary management. As a trend, subjects who had pharyngeal flaps were judged marginal for several years. Otherwise, there was little difference in articulation scores or velopharyngeal closure ratings between those subjects who had flaps versus those who did not. Data for articulation scores (IPAT) and VPC ratings are presented for subjects who were not secondarily managed since inclusion of all subjects in the marginal group would skew articulation scores and VPC ratings.

Perhaps the most striking aspect of the marginal group was in fact their variability. Graphic plots were made for each individual over time in an attempt to determine if subjects fell into specific closure pattern groups which might give us clues as to the stability of the closure mechanism. Unfortunately, many of the subjects could not be grouped. As Figures 1-A and 1-B demonstrate, some subjects showed a haphazard pattern which with our current knowledge is impossible to explain. For other subjects patterns were more clearly observed: 1) some subjects showed marginal competency until about age seven and then achieved competency and maintained it (Figure 1-C). 2) Other subjects were consistent throughout the examination period (Figure 1-D). 3) Still others demonstrated marginal closure, then closure, and then a decrease in closure for approximately a year during the 12, 13 or 14th year (Figure 1-E).

As a group, subjects in the marginal velopharyngeal closure category were older when best closure was achieved. For example, in the competency group the best ratings of closure were achieved at age six. For the marginal group, the best closure ratings were achieved at age 11. At this age 35% of the subjects were considered as marginal, where as at age six, 65% were considered marginal or incompetent. (All but three of the 15 subjects who subsequently had pharyngeal flaps were judged as marginal at age six). As Table 2 illustrates, the marginal group tended to improve in velopharyngeal competency ratings while the closure group tended to get worse. The marginal group also decreased in severity ratings of nasality and articulation defectiveness as age increased (see Table 2).

The findings of the velopharyngeal incompetent group must be viewed differently than for the other two velopharyngeal groups because 28 of the group of 30 had additional physical management (pharyngeal flap surgery) during the period of study, usually at approximately six years of age. For the two remaining subjects, one family refused further management and follow-up, while the second subject remains with a very marginal mechanism and probably should have had a pharyngeal flap procedure.

As has been previously demonstrated by Van Demark, Kuehn, and Tharp (1975), the articulation of these subjects without additional management improves very little; however, with management the articulation of this group, although usually not as good as the other two groups, is highly comparable (see Table 2). The articulation errors made by this group appear to be more highly related to their original condition rather than velopharyngeal incompetency. If you will note from Table 1, 27 of 30 subjects had either a unilateral cleft (N=16) or a bilateral cleft

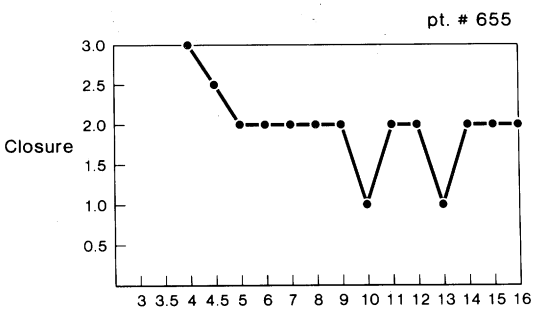

Figure 1A

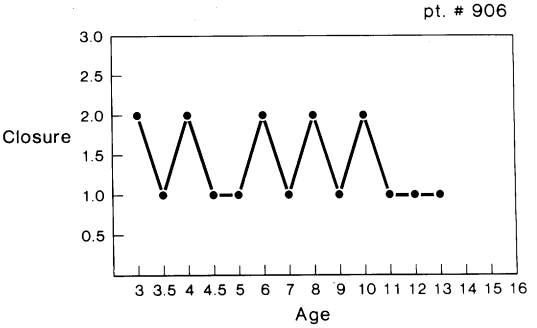

Figure 1B

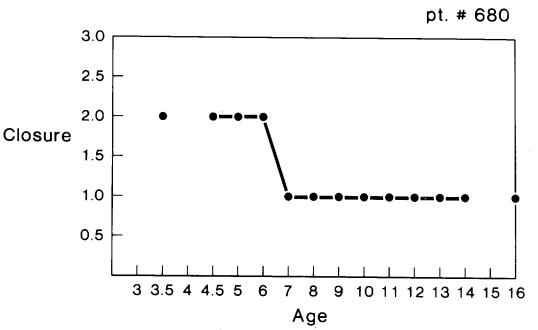

Figure 1C

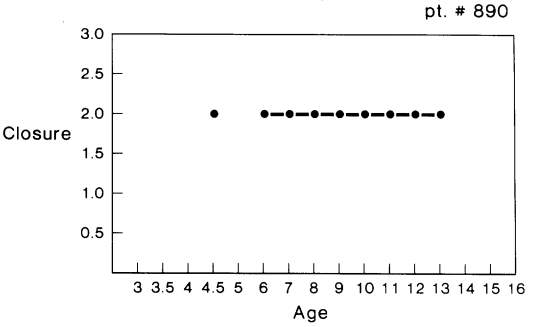

Figure 1D

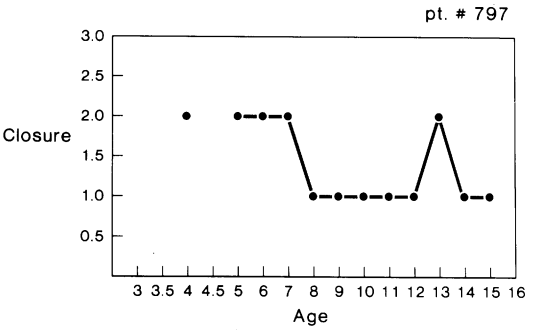

Figure 1E

(N=11) and thus they had a higher risk of having articulatory errors related to their dental status. As is demonstrated in Table 2, the mean severity rating of nasality decreases remarkably after management and is only slightly higher than the other two groups. Table 2 also demonstrates that the clinical rating of competency is as good if not better than the other two groups.

Discussion

It has often been assumed that once velopharyngeal closure has been achieved that velopharyngeal closure is maintained. When subjects are studied on a longitudinal basis; however, some lack of stability is evident. Individuals with consistent velopharyngeal closure may, during the teenage years, show a slight breakdown in the mechanism, but in our study the chances of their needing additional management were minimal. Various compensatory changes, however, may occur. Subjects with marginal closure have a greater risk of needing further management (approximately one-third), but most achieve articulation scores highly comparable to the closure group and approximately two-thirds achieve ratings of velopharyngeal competency. This

group shows a great deal of variability in velopharyngeal competency ratings with few consistent patterns demonstrated.

Observations on the marginal group did not provide clear cut evidence as to which subjects would in time require pharyngeal flaps. Certainly further research is needed to better understand the marginal mechanism and compensatory movements. We would suggest that research be done on a longitudinal basis since the variability of these subjects from one observation to another may be very great. Adenoid atrophy in all probability contributes to the variability. The fact remains that some subjects may develop additional movements which facilitate closure and thus alleviates the need of additional surgery, while other patients may not.

One must consider each patient in management decisions. For example, two patients in the closure group exhibited normal speech until puberty. On evaluation at that time, both were noted to exhibit a marginal mechanism. Lateral x-rays (cine) confirmed this observation. A year later one patient exhibited the same problem and reported teasing in school; thus secondary management was done. Although in time perhaps the patient may have achieved adequate closure, we felt the risk was too high. The other patient exhibited no problem one year later.

Another patient consistently exhibited a marginal mechanism. Over the years management had been considered, but the articulation was normal and there was minimal nasal voice quality. Finally at about age 17 the mother reported that the patient did not get the lead in the school musical because when under tension her speech became much worse. We put the patient in a tense situation and velopharyngeal closure was not attained. After management (a pharyngeal flap) speech was normal and the patient is now pursuing a degree in speech pathology.

These patients are presented only to demonstrate that it is important to ask questions about how the patient is talking in other than observed situations. It is obvious that under optimal conditions a patient with a marginal mechanism may be considered a normal speaker, yet few people function optimally 100% of the time. A better understanding of the variability of the velopharyngeal mechanism and compensatory movements should help determine realistic management procedures. It appears that a good deal of basic research in this area is needed.

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