Roll-Y Pharyngoplasty and Palate-lengthening Procedure

EDWARD N. HAMACHER, M.D., LL.B.
Spokane, Washington

Velopharyngeal sphincter incompetence with its associated nasal emission in speech has taxed the ingenuity of the surgeon and the speech pathologist from the very beginning of these disciplines: the surgeon, in attempting to restore the velopharyngeal sphincter to a normal anatomical, physiological unit; and the speech pathologist, in training the anatomical components of the reconstructed velopharyngeal sphincter to function so that normal or acceptable speech is obtained.

It has been estimated that following primary closure of a cleft palate, 60% or more of the cases obtain velopharyngeal closure and normal speech (*14*). One interpretation of that estimate is that in these cases the velopharyngeal structures are apparently normal except for the palatal cleft and that by closing that cleft a normal sphincter is obtained.

The remaining 40% of repaired cleft palate cases require some secondary operative procedure since the velopharyngeal sphincter is apparently deficient in either its anterior, lateral, or posterior dimensions or by a combination of these. The problem presents itself in the following types of cases: a) when the repaired soft palate is short, seen especially in clefts involving just the soft palate; b) when inactive palatal muscles are present, observed in such cases as the badly-scarred palate, or the submucous cleft, or in cases when a posterior pharyngeal wall flap has been unsuccessful; c) in the case of pharyngomegaly (an overly large pharynx in the presence of a palate normal in mobility and length); and d) when the muscles of the posterior pharyngeal wall, namely the superior constrictor and the palatopharyngeal muscles, function poorly.

These conditions are all present to some degree in any case of velopharyngeal sphincter incompetence. The problem is directly related to the abnormal anatomical relationship of the velopharyngeal muscles responsible for speech, namely the levator palatini, the palatopharyngus, and the superior constrictor muscles. These muscles are in such an abnormal anatomical position that they are so taut or so relaxed that they cannot possibly function from a physiological standpoint (Figure 1A).

Surgical procedures which have been advocated for correction of the

The material in this paper is similar to that presented in a film entitled "Roll-Y Pharyngoplasty and Palate-lengthening Procedure", shown at the 1966 meeting of the American Cleft Palate Association, Mexico City.

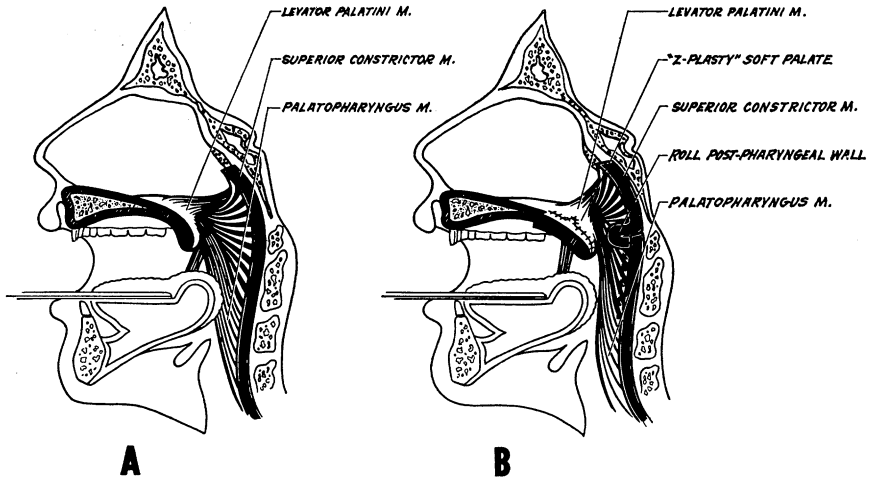

FIGURE 1. Diagrammatic representation of velopharynx, demonstrating A, abnormal anatomic position of the levator palatini, superior constrictor, and palatopharyngus muscles and a short palate with resultant wide velopharynx, and B, the reconstructed velopharynx with the muscles in their normal position of function, the soft palate lengthened, the roll of mucous membrane, and the superior constrictor muscles on the posterior pharyngeal wall with resultant narrowing of the velopharynx.

problem of velopharyngeal incompetency are generally classified according to that area of the deficient velopharyngeal sphincter which they are designed to correct, as follows: *lengthening the soft palate,* such as a) by retroposition, namely the Dorrance push-back operation (*5*) or its variations, such as that advocated by Millard (*10*), b) the Veau-Wardill V-Y procedure, and c) Z-plasty of the soft palate; *advancing the lateral pharyngeal wall medially,* such as a) lateral pharyngeal space dissection, as advocated by Beavis (*1*), in which the lateral pharyngeal wall is advanced medially, posteriorly, and superiorly, and b) the velopharyngeal operation by Neuner (*12*), which advances the lateral pharyngeal wall medially and the posterior pharyngeal wall anteriorly; *advancing the posterior pharyngeal wall forward* (the pharyngoplasty procedures), such as a) the Hynes (*8*) type, by means of bilateral mucous membrane and muscle flaps raised from the lateral pharyngeal wall and placed on the posterior pharyngeal wall, resulting in a projecting mass of tissue above the atlas tubercle (the flap donor sites are closed primarily thus reducing the transverse diameter of the pharynx), b) the Moore-Sullivan (*15*) procedure which also utilizes bilateral mucous membrane flaps raised from the lateral pharyngeal wall and then rotated to the nasal side of the soft palate, adding mass to that structure (the flap donor sites are closed primarily thus reducing the transverse diameter of the pharynx), and c) retropharyngeal implantation of autogenous implants (cartilage by Lando, *9*) or exogenous materials (silicone by

Blocksma, *12*); and *velopharyngeal obturator procedures,* such as a) the posterior pharyngeal wall flap of Rosenthal (*13*), based either superiorly or inferiorly, as popularized by Moran (*11*) or any of the variations of this procedure such as those advocated by Edgerton (*6*) or Chase (*4*), and b) by mechanical means such as the use of an obturator.

These procedures are similar, in that they are all methods for reducing the size of the incompetent velopharyngeal sphincter in only one or two dimensions.

The anatomical-physiological relationship of the normal functioning palate in speech is basically that of the levator palatini contracting and pulling the soft plate upwards and back, the palatopharyngus assisting in pulling the soft palate posteriorly and narrowing the lateral pharynx, and the superior constrictor pulling the soft palate posteriorly, the lateral pharynx medially, and the posterior pharyngeal wall forward (*3*) (Figure 1).

The Roll-Y pharyngoplasty and palate lengthening procedure is designed and presented here as a technique by which the total reconstruction of the size of the incompetent velopharyngeal sphincter is approached by restoration of all the anatomical components to their normal relationship so that normal physiological function may be obtained in one operative procedure (See Figure 1B).

Technique

Various steps in the procedure are presented in Figure 2.

It is essential that the surgeon work in a clean velopharynx and for this reason all diseased and hypertrophied tonsils and adenoids should be removed at a minimum of six weeks prior to undertaking this procedure.

General oral endotracheal anesthesia is administered. A Dingman mouth gag is used to obtain the maximum oral exposure. The midline incision of the soft palate is outlined with marking ink, then the soft palate is split. This incision is carried anteriorly to the hard palate. The soft palate is then retracted laterally and sutured to the mucous membrane of the cheek. The superiorly-based V flap is outlined with marking ink on the posterior pharyngeal wall. This flap is made as large as possible and the base placed as high as possible above the tubercle of the atlas. The flap is then incised, carrying the incision through the mucous membrane and the superior constrictor muscle down to the fascia. Then, with hook and curved scissors, the lateral flaps are undermined. Next the superiorly-based flap is hooked at its tip, retracted upwards, and undermined with scissors. A suture is then passed through the tip of the flap, then through the base of the flap at the midline, then back through the base, and through the tip, and tied. This creates the roll of mucous membrane and superior constrictor muscle. Then, if indicated (especially in pharyngomegaly), the palatopharyngus muscle is freed, brought to the midline, and sutured together, thus shortening the direction of

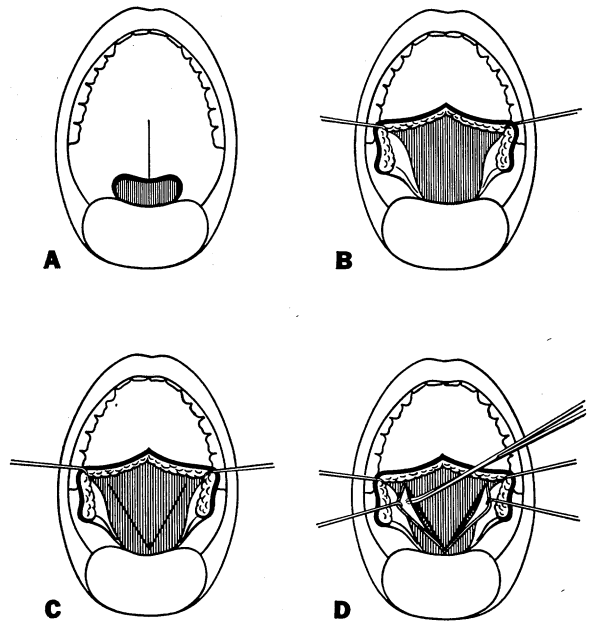

FIGURE 2A–D.

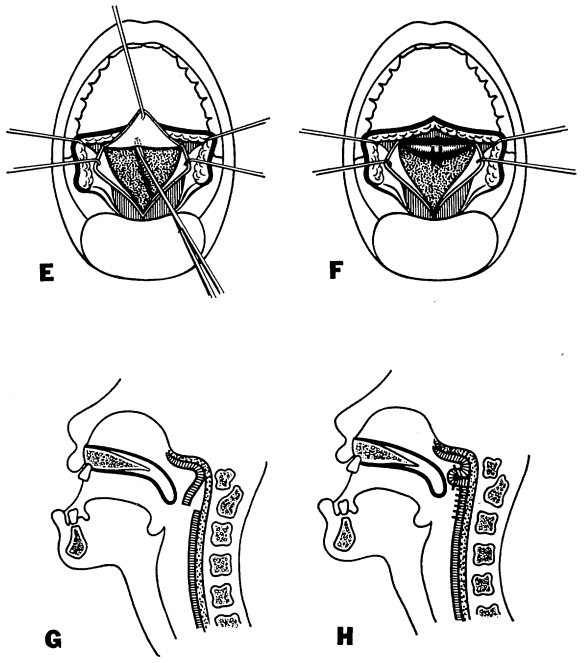

FIGURE 2E–H.

FIGURE 2. Diagrammatic representation of the Roll-Y procedure: A, incision in the soft palate; B, soft palate flaps retracted; C, outline of incision of superior based, posterior pharyngeal wall flap; D, incision of flap through mucous membrane and muscle and undermining of lateral flaps; E, superiorly-based flap being undermined; F, flap rolled on itself; G, lateral view of flap being elevated; H, flap elevated and rolled on itself; I, flap rolled on itself and donor site closed in a Y, thus completing the Roll-Y pharyngoplasty; J, outline of lateral relaxing incisions and Z-plasty incisions on the soft palate; K, incisions made and blunt dissection of lateral pharyngeal space; and L, closure of the Z-plasty flaps.

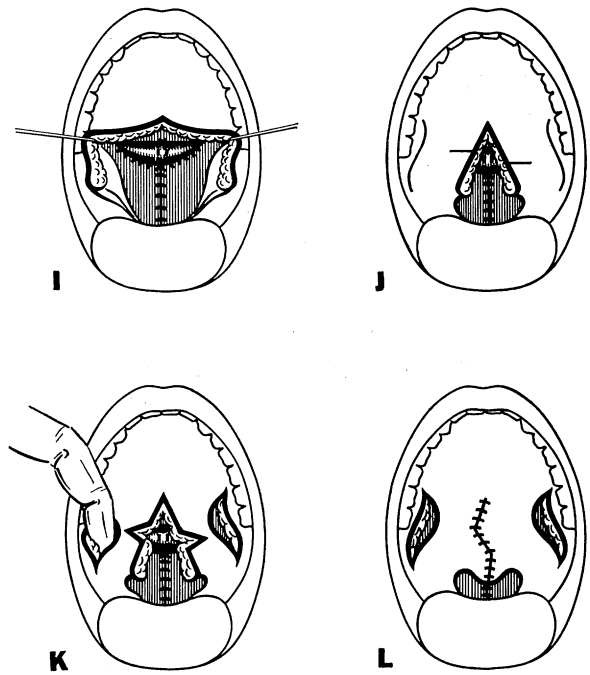

FIGURE 2I–L.

pull of the muscle and placing it in an anatomical position which approximates the normal. Next, the donor site of the flap in the posterior pharyngeal wall is closed in the form of a Y, and the Roll-Y pharyngoplasty has been accomplished.

The retracting sutures attaching the soft palate to the cheek mucous membrane are now released, returning the soft palate flaps to the midline. Z-plasty and lateral relaxing incisions to be made are outlined with marking ink. The relaxing incisions are made first. This incision is begun over the pterygomandibular ligament, carried anteriorly to the posterior border of the alveolar process and then anteriorly along the alveolar process. Soft tissue of the hard palate is elevated, and the muscles of the soft palate are freed from their hamular attachment either by fracturing the hamulus or by sharp dissection. The pterygomandibular ligament is incised and the dome of the pharyngomaxillary fossa (or the lateral pharyngeal space) is exposed. Blunt dissection is utilized to complete the dissection of the lateral pharyngeal space. The entire muscle bundle of the soft palate is displaced posteriorly and medially. The Z-plasty incisions are made on both medial sides of the soft palate. These flaps are rotated and sutured together in layers, starting with the mucous membrane of the nasal side of the soft palate and uvula. The lateral, relaxing incisions are sutured as high as possible on the lateral pharyngeal wall and the remainder of the incisions are left open to granulate in.

The anterior and anterior-lateral diameters of the velopharyngeal sphincter have thus been reduced by the posterior, posterior-medial, and superior displacement of the muscles of the soft palate. The posterior pharyngeal wall has been advanced anteriorly by the roll of mucous membrane and superior constrictor muscle. The posterior lateral pharynx has been narrowed by shortening of the palatopharyngus and superior constrictor muscles in closing the donor site of the roll in the shape of a Y. The muscles of the velopharyngeal sphincter are now placed in their normal anatomical-physiological position and a normal velopharynx thus restored. 4-0 catgut is used throughout the procedure.

Postoperative Care

For several days the throat is quite sore, especially if the palatopharyngus muscle has been repositioned. Nembutal suppositories are used liberally, as is Demerol. Antibiotics are given for ten days. The patients feel like taking and are given liquids on the first or second day. After 48 hours, they are offered and most of them take pureed foods, to be continued for three weeks. They are hospitalized for approximately five days. Speech therapy is commenced in one month to six weeks.

Preliminary Results

The standard employed in judging the speech of this series of cases was the degree to which a given sample deviates from so-called normal speech. The scale was as follows: *zero,* indistinguishable from normal speech; *one,* some noticeable deviations but no difficulty in understanding the speech sample; *two,* speech understandable if the topic is known; and *three,* speech unintelligible.

This procedure has been performed on 46 patients. Of these, 41 had repaired cleft palates, four had submucous clefts, and one had a submucous cleft which had had previous surgery. In the four subjects with submucous cleft, all were judged to demonstrate complete closure and normal speech postoperatively. The one with a submucous cleft and previous surgery was a retarded child and did not obtain successful closure after the first attempt of the Roll-Y. The procedure was re-performed 9 months later, following which she obtained good closure and, after much speech therapy, demonstrated acceptable speech. Speech results for the 41 subjects with repaired cleft palate are presented according to age range in Table 1. In the younger age group, 24 demonstrated velopharyngeal closure, in the middle age group, 9 showed closure, and in the older age group, none showed closure.

One 5-year-old child had an ear infection of the transitory type which cleared up immediately following the pharyngoplasty. Another 5-year-old developed severe ear infection six months after the Roll-Y was performed.

There have been no deaths or other complications during the three years in which the procedure has been performed.

TABLE 1. Number of subjects with repaired cleft palate, obtaining closure and judged to demonstrate various degrees of speech proficiency, according to age.

age range (years)	*number with closure*	*rating*				*total*
		0	*1*	*2*	*3*	
5 to 8	24	22	2	2	0	26
9 to 14	10	8	1	1	—	10
15 to 44	—	—	3	2	—	5

Discussion

In theory and in fact the problem presented is one of reconstruction of a normal velopharynx. The reconstruction should not be accomplished by filling the velopharyngael space with space-occupying material of either autogenous or exogenous source, because in that instance the muscles remain in their abnormal anatomical position, too taut to contract maximally or too relaxed to effectively pull or contract. The reconstruction should not be accomplished by pulling the string tighter, as it were, since bringing the borders closer together is of little value unless there is function (as seen in velopharyngeal stenosis) (*7*).

Ideally, the reconstruction of the velopharynx should be accomplished by including the muscles of speech in the tissues used in the reconstructive procedure. In that way, a normal velopharynx is reconstructed, one that is physiologic allowing the passage of air and of mucous when the muscles are relaxed and resulting in closure when they are contracted. The Roll-Y pharyngoplasty and palate-lengthening procedure is designed to accomplish this type of reconstruction of the velopharynx.

This procedure is used as a secondary operation in cases of velopharyngeal incompetence secondary to cleft palate repair. It may also be used as a primary procedure when there is velopharyngeal incompetence without an overt cleft. If, after a fair trial of speech therapy (from six to nine months) closure is not obtained, the procedure can be re-performed in its entirety or in portions.

Summary

A new concept of reconstruction of the velopharyngeal sphincter incompetence is presented. The technique has the advantages that a normal velopharynx is reconstructed, the muscles responsible for velopharyngeal closure are placed in their normal anatomical position, it is physiological, it is relatively easy to perform, and there are virtually no complications. The surgical technique is described and the results obtained in a series of 46 cases are presented.

reprints: *Dr. Edward N. Hamacher*
Paulsen Medical and
Dental Building
Spokane, Washington 99201

References

1. Beavis, J. O., Lateral pharyngeal space dissection as an adjunct to reconstructing the muscular velopharynx. *Plastic reconstr. Surg., 13,* 210–221, 1954.
2. Blocksma, R., Correction of velopharyngeal insufficiency by silastic pharyngeal implant. *Plastic reconstr. Surg., 31,* 268–274, 1963.
3. Braithwaite, F., *In* Modern Trends in Plastic Surgery, Gibson, T. (ed.). Philadelphia: W. B. Saunders, pp. 30–49, 1964.
4. Chase, R. A., A modification of the combined pushback and pharyngeal flap operation. *Plastic reconstr. Surg., 36,* 165–172, 1965.
5. Dorrance, B. M., and Bransfield, J. W., Push-back operation for repair of cleft palate. *Plastic reconstr. Surg., 1,* 145–169, 1946.
6. Edgerton, M. T., Jr., The island flap push-back and the suspensory pharyngeal flap in surgical treatment of the cleft palate patient. *Plastic reconstr. Surg., 36,* 591–603, 1965.
7. Hamacher, E. N., Nasopharyngeal stenosis—a method of repair utilizing transposed flaps. *Plastic reconstr. Surg., 19,* 163–170, 1957.
8. Hynes, W., Pharyngoplasty by muscle transplantation. *Brit. J. plastic Surg., 3,* 128–135, 1950.
9. Lando, R. L., Transfer of cadaveric cartilage into the posterior pharyngeal wall in treatment of cleft palate. (Translation) *Stomatologia (Moskva), 4,* 38–39, 1950.
10. Millard, D. R., Jr., Wide and/or short cleft palate. *Plastic reconstr. Surg., 29,* 40–57, 1962.
11. Moran, R. E., The pharyngeal flap operation as a speech aid. *Plastic reconstr. Surg., 7,* 202–213, 1951.
12. Neuner, O., A new method for the velopharyngeal operation. *Plastic reconstr. Surg., 37,* 111–116, 1966.
13. Rosenthal, W., Zur Frage der Gaumenplastic. *Zentralbl. F. Chir., 51,* 1621–1628, 1924.
14. Spriestersbach, D. C., *In* Reconstructive Plastic Surgery, Converse, J. M. (ed.). Philadelphia: W. B. Saunders, pp. 14–63, 1964.
15. Sullivan, D. E., Bilateral pharyngoplasty as an aid to velopharyngeal closure. *Plastic reconstr. Surg., 27,* 31–39, 1961.
16. Wardill, W. D. M., Technique of operation for cleft palate. *Brit. J. Surg., 25,* 117–130, 1937.