IV. Pharyngeal Flap
Attachment to the Velum
Introduction to Part IV

A gloomy prediction in '33

As early as 1933 Dorrance predicted a dismal future for the use of a pharyngeal flap in the correction of the split palate:

[Although] ingenious . . . this operation . . . will not stand the test of time, despite the excellent results obtained by Rosenthal.

He complained that it diminished the lumen of the pharynx, produced scar and interfered with the palatopharyngeal muscle function, giving these reasons:

The procedure does not attempt to establish the desired "palatopharyngeal-sphincter." If the pharyngeal flap includes a portion of the superior constrictor muscle, the pterygopharyngeus portion of this muscle becomes destroyed and its atrophy is inevitable. Staphylopharyngorrhaphy establishes "stomatolalia," interferes with normal ventilation of the Eustachian tubes, and favors the accumulation of nasal secretions.

P. P. F. epidemic continues in '80

In spite of the apparent unphysiological nature of a pharyngeal synechia to the palate, there has continued to be a worldwide epidemic of flaps. They have been used in such a variety of ways that it takes several chapters to trace the progression.
36. *Velopharyngeal Synechiae with Various Pharyngeal Flaps*

**FIRST AN ADHESION**

In 1865 the remarkable Gustav Passavant described his adhesion method to reduce the velopharyngeal aperture. Ideal position for the adhesion was noted, and it was strategically placed on the free border of the velum and the posterior pharyngeal wall. Equivalent areas, 8 lines long and 5 lines in depth, were denuded of epithelium. The velum was then attached to the pharynx with sutures, with what Passavant described as better results.

**INFERIORLY BASED PHARYNGEAL FLAPS**

From Stellmach’s scholarly research and translations of the original German, presented in *Plastic and Reconstructive Surgery*, 1972, revealing information has been provided on the earliest pharyngeal flaps.
Karl Wilhelm Ernst Joachim Schoenborn was a student under von Langenbeck at the University of Berlin and later was appointed professor and chief of surgery at the University of Königsberg. In 1876 he described a flap as it is used today. He wrote with modesty, giving credit to those before him but demonstrating his own remarkable clairvoyance:

I believe it is a known fact among most surgeons that healing of the congenital cleft palate can be achieved, with a high degree of certainty, by the uranoplasty introduced by von Langenbeck and by a staphyloorrhaphy. However, after even the most successful operation the speech of these patients leaves much to be desired; there is severe nasality. . . .

Passavant pointed out that the patient retains a nasal tone, despite the good healing achieved, because the newly formed soft palate is too short to accomplish velopharyngeal closure. . . .

Please allow me to bring a new surgical method to your critical attention. . . . This consists of incorporating a flap, taken from the posterior pharyngeal wall, between the two halves of the soft palate.

About 4 years ago, as I was discussing with my friend and colleague Trendelenburg the possibility of closing an abnormally wide cleft palate . . . he advanced the idea that it might be possible to join a flap from the posterior pharyngeal wall to the soft palate. If I remember correctly, he also made some important attempts on human bodies and animals; however, the operations appeared to be very difficult and, as far as I know, there were no further attempts. . . .

I performed this operation on a female patient on July 2, 1874. This patient, Emma Kollecker, aged 17, had a congenital (unoperated) cleft of the hard and soft palate. . . .

After induction of general anesthesia . . . I made rim incisions along the cleft borders. With a long scalpel . . . I outlined a flap about two cm long and 4 to 5 cm wide, with its long axis vertically and its base caudally, from the posterior wall of the pharynx . . . .

The incision was carried through the mucosa and underlying muscles. . . . (Particular attention must be paid to keeping the scalpel within the loose areolar tissue beneath the muscle, so that no part of the flap is thinner than the other.) Next, I detached the mucoperiosteal layer of the hard palate enough so that it and the soft palate were sufficiently mobile. Then I trimmed the edges of the flap so that it was in a triangular form, with the tip at the upper end. This was sutured then between the dissected two halves of the velum . . . . The cleft in the hard palate was closed with 3 additional sutures.

Schoenborn admitted partial separation of the flap on the left side and opening in the hard palate, which was corrected with a von Langenbeck operation.

Schoenborn continued:
The result of the operation, as far as improvement of speech was concerned, was very important. Immediately after healing had taken place, the patient's speech was absolutely clear and easily understandable to everyone. The nasality had not disappeared completely, but it diminished week to week as the patient learned, by speaking, to close both side openings through the activity of the pharyngeal muscles. These muscles being on the sides of the pharyngeal flap facilitate closing the communication between the nasal and oral cavity.

The patient had no difficulties in swallowing, nor in breathing through her nose. . . . Until this patient, I had not seen such a remarkable improvement in speech immediately after healing took place.

Ten years later, in 1886, Schoenborn reported progress with his flap:

I have now done the staphyloplasty on 20 patients. Of these, one died of septic pneumonia; in 3 other cases, the transplanted flaps became necrotic. Healing was achieved in 16 cases; in two of them it was limited to one side of the flap, but after a second operation the other side also healed. In the remaining 14 cases, healing was uneventful.

Rosenthal

In 1924 Wolfgang Rosenthal of Berlin revived Schoenborn's pharyngeal flap based inferiorly, combining it with a modified von Langenbeck palate closure for all cases involving the hard and soft palate. This combined procedure was done in one sitting and thus is the first use of the pharyngeal flap primarily in the cleft closure. Like Halle and Ernst, Rosenthal carried out lateral relaxing incisions close to the alveolar ridge and back along the pterygomandibular ligament to within 1 cm. of the last mandibular molar tooth. Rosenthal claimed:

You get perfect or almost perfect speech results if you combine a Langenbeck operation with a pharyngoplasty during the same procedure.

At the First International Congress held in Stockholm in 1955, Rosenthal reminisced:

When I performed a velopharyngoplasty for the first time, my reasons were less mechanical ones. At this time (1915–1916), I was occupied with an investigation of the muscular neurotization. A student of medicine with a completely mutilated velum was sent to me from Leipzig. The young man
spoke indistinctly and, therefore, had been dissuaded from his studies. His velum was totally paralyzed but the posterior pharyngeal wall seemed to be innervated. I took a muscular-mucous flap from the pharynx in order to obtain a muscular neurotization of the immobile velum parts. The success obtained was an astonishing one. The student, today, is an experienced physician at Zwickau-Saxony. He speaks normally.

Encouraged by this, I applied that method not only in cases of velum shortening but also in two cases of velum paralysis remaining after diphtheria. Time of operation: not before the age of 12 years. . . . Closure of the pharyngeal defect by catgut sutures is necessary.

Wolfgang Rosenthal was as famous a musician and singer as he was a surgeon. He sang under many well-known conductors, such as Furtwängler, Vihirch, and Bruno Walter. His friend Trauner described him as serene, open-hearted, full of wit and a true artist.

R. Meyer of Lausanne, recalling his charm, wrote:

He was known as the best ladies’ speaker at congresses. However, once in a speech, he declared that man is more beautiful than woman and that this fact is well illustrated by the German language since we say: mmmm! aaaa! nnnn! = mann . . . and on the other hand: wwww! eeee! iiii! b = weib.

In Bratislava in 1965 I rode in a car partway with Rosenthal and a group of East German plastic surgeons on their way back to their sector and remember him clearly: handsome, with chiseled features, white hair and a gracious smile. To add to his distinctions, he once operated on a lip cleft in a lion cub.

Rosenthal had to turn a charming old castle in the village of Thallwitz into a maxillofacial surgery hospital, and here it is said he operated on 30,000 primary clefts coming from Germany and Czechoslovakia. It is sad that this noble surgeon was never allowed to have his own proper clinic only because he was supposed to have had a Jewish great-grandfather. The irony is even greater because his great-grandmother confessed on her deathbed that her first son, Wolfgang’s grandfather, was actually the son of a young count Schoenborn whom she had known while on duty in a castle in Poland. Fate played a second Schoenborn’s trick on him, for his pharyngoplasty eventually was called the Schoenborn-Rosenthal flap, but alas, for an entirely different Schoenborn.

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In 1951 Dunn noted that patients with a pharyngeal flap required less speech therapy than those with other repairs.

In 1972 Poul Fogh-Andersen of Copenhagen wrote of his inferiorly based pharyngeal flap attached to the mid-posterior oral surface of the velum:

As you possibly know, I was the first to “introduce” the pharyngeal flap operation in Scandinavia (1953). . . . In England, it seemed to be nearly unknown, even in Basingstoke, at the time I worked with the problem—as will appear from the enclosed copy of Gillies’ letter from 1952.

Gillies’ letter read:

I have not really enough experience of the pharyngeal flap operation to state that the speech results are worthy of the effort. I think they should be.

Dingman

In 1963, at the Third International Congress in Washington, D.C., Reed O. Dingman, W. C. Grabb and H. H. Bloomer of the University of Michigan reported dissections of 25 sagittally cut human heads, demonstrating:

The circular fibers of the superior constrictor muscle can be identified beneath the mucosa of the posterior pharynx . . . [and extend] cephalad to the level of the junction of the first cervical vertebra and the basilar portion of the occipital bone. . . .

The posterior surface of the superior constrictor muscle is intimately related to a thin discrete buccopharyngeal fascia. The plane dorsal to this buccopharyngeal fascia is the retropharyngeal space which contains loose areolar tissue and separates the structures of the pharynx anteriorly from the prevertebral muscles and fascia immediately posteriorly. This loose areolar plane permits ready elevation of a pharyngeal flap. . . .

The internal carotid artery, with the cervical sympathetic nerves on its medial aspect, was identified in the dissections. In the adult cadavers, the distance from the lateral incisions of the pharyngeal flap to the internal carotid artery was measured to be between 1 and 1.5 cm.

In these sagittally cut sections, a definite concavity of the posterior pharynx above the level of the second cervical vertebra was readily apparent. This concavity begins at the upper edge of the second cervical vertebra and deepens gradually over the first cervical vertebra to reach its deepest point at the lower aspect of the basilar portion of the occipital bone.
They described their operative technique for an inferiorly based pharyngeal flap:

The lateral incisions are placed so as to include almost the entire width of the posterior pharynx in the flap. The depth of the incisions is to the shiny white tendon of the longus capitus muscle. The flap is undermined with right angle scissors. ... The flap may include a portion of adenoid tissue. ...

After undermining the lateral pharynx with right angle scissors, the posterior pharyngeal donor site is closed with figure-of-eight No. 3-0 chromic catgut sutures. ...

The distal end of the pharyngeal flap is held on the oral surface of the soft palate under minimal tension in order to outline the size of the soft palate flap. This flap of mucosa and submucosa based on the posterior edge of the palate is raised by sharp dissection. The two flaps are then sutured back to back.

They reported that, out of 50 posterior pharyngeal flap patients over one year after surgery, 21 had satisfactory speech records.
which revealed improvement in articulation with few exceptions and invariably lessened hypernasality. Only seven were in the acceptable range, but all had shifted from moderately severe hypernasality to very mild hypernasality.

**Huffstadt**

A. J. C. Huffstadt of the Netherlands, besides doing a bit of bloodhound breeding and keeping three-fourths of an acre of pink peonies, mauve dahlias and apple trees, devotes the majority of his time to surgery. In 1970, in the *British Journal of Plastic Surgery*, Huffstadt, with J. M. H. Borghouts and A. J. Moolenaar of the University Hospital of Gröningen, expressed preference for the simplicity and freedom from fistulae of the Rosenthal type of pharyngeal flap. Their flap was based centrally and as high as possible, including the whole width of the dorsal nasopharyngeal wall. When sutured into the prepared cleft on the soft palate, the flap lies almost horizontally. As the donor area healed and contracted, they noted, the base of the flap was raised even higher.
Chronic atrophic rhinitis or ozena, characterized by atrophic nasal and pharyngeal mucosa, formation of crusts and a repulsive smell, has an unknown etiology and a rare spontaneous cure. In 1976 A. J. C. Huffstadt and P. E. Hoeksema of Gröningen advocated reduction of nasal airflow with a pharyngeal flap. They reported:

The first 10 patients were treated with the wide flap we use for rhinolalia. All of them had some difficulty in nasal breathing. Next, the original Rosenthal (1924) method with a narrow flap and closure of the donor area was performed but it was obvious that this was very much less effective than the wide flap.

A flap of about three-quarters width of the dorsal pharyngeal wall is now used as a compromise between an effective reduction of the nasal airway and reasonable breathing.

LATERAL ADHESIONS FOR A LARGE PHARYNX

Harold L. D. Kirkham was a plastic surgeon particularly interested in ears and palates. Born in England, he worked his way as a youth to America on a freighter, studied medicine at the University of Texas and returned to England for plastic surgery training with Gillies. A U.S. Navy veteran of both world wars, Kirkham was chief plastic surgeon at San Diego Naval Hospital and later at the U.S. Naval Hospital in Houston. He received the Legion of Merit and retired a captain. He was exceptionally talented beyond his surgery, excelling as a painter (he exhibited his prize-winning work, “Three Monks,” in New York City), and as a violinist for the Houston Symphony. He never took a trip without his golf clubs and seldom returned without a trophy. Once he surreptitiously arranged for golfer Sam Snead, then an enlisted man with a back ailment, to remain a couple of extra weeks in the San Diego Naval Hospital so he could improve his golf game during afternoon sessions at a local golf course. This tall, lean Britisher, who turned into a drawling, tall-tale-telling Texan, could attract and hold a crowd all evening with his fascinating yarns. His favorite palate tale involved a family who came to consult him about the daughter’s cleft palate. During the
consultation he asked the mother whether there was any history of this deformity on her side of the family, and she denied any clefts. Then he asked:

What about your husband’s family?

The mother said that she did not think so, but that he was out in the waiting room. Kirkham called the father in, noticing a typical cleft lip scar, and inquired:

Is there anything like your daughter’s deformity on your side of the family?

The father answered in severe nasal speech:

No, there ain’t nothin’ like that in my family.

Kirkham then looked in the father’s mouth and finding an extensive cleft of the entire palate, asked:

What about that hole in the roof of your mouth?

The father replied, again nasally:

Oh that ain’t nothin’, it’s been there all my life!

In 1927 Kirkham revived the velopharyngeal adhesion principle. His comparison of measurements of normal and cleft palate specimens of the same age at the Hunterian Museum of the Royal College of London indicated that velopharyngeal insufficiency was due more to the widened pharynx than to the shortened velum. He attempted to shorten the superior constrictor muscle by denuding lateral portions of it and suturing these raw areas to corresponding denuded sides of the palatopharyngeus muscles. Although the application of the principle in a 6-year-old boy was a failure, the importance of the wide pharynx was brought to the attention of palate surgeons.

**Lateral Flaps**

In 1932 Réthi designed an operation for "rhinolalia aperta" to correct the effect of an over-large velopharyngeal space. He turned a mucosal flap from the lateral posterior pharyngeal wall based medially and obliquely. To face this flap, he lifted, in leaf-of-book
fashion, a mucosal flap from the posterior pillar of the fauces, based inward. These two flaps were coapted with sutures. Réthi advised repeating this operation on the opposite side when one procedure did not overcome velopharyngeal insufficiency. He reported two successful cases. This rather intriguing modification has never enjoyed popularity but possibly has more merit than realized.

The Kirkham-Réthi principle was revived by Richard Trauner of Graz in the mid-50's, as noted by his teacher Rosenthal, who wrote in the 1957 Stockholm Transactions:

He performs an orificial closure of the velum, leaving the patient only a median aperture for breathing.

Rosenthal presented his modification of Trauner's modification of Kirkham-Réthi lateral attachments.

**Pharyngeal Flaps with Base Superior**

It is not generally realized that, although Schoenborn started with an inferiorly based flap, he eventually changed to a superiorly based flap and gave sound, logical reasons for this switch. He also noted the possibility of dividing the flap attachment years later. In 1886 he wrote:

With time, the method of operation becomes simple. . . . A rather wide flap of the posterior pharyngeal wall is developed. Now, I regularly place its base cranially, high up around the pharyngeal tonsil. (Formerly, I made the bases
of these flaps caudally, but this is not ideal because the mucosa from the
region of the adenoids is not suitable for suturing, being extremely fragile.)
This flap is detached with the help of a long hooked forceps, and with
Cooper’s scissors. It is sutured to the raw edges of the two halves of the soft
 palate. . . .

After 6 to 8 weeks, the wound in the wall of the pharynx is healed and
uranoplasty can be undertaken. However, it is better to wait about 6
months, during which time the width of the cleft in the hard palate
diminishes. . . .

I am convinced that the operation should aim at later dividing the
connection between the velum and pharynx again, if the patient maintains
acceptable speech for some years.

In 1892 Bardenheuer suggested using a pharyngeal pedicle
with its base superior.

Padgett

Earl Calvin Padgett of the University of Kansas School of Medi­
cine, Kansas City, Missouri, was born into a family of bankers in
a small town in Kansas. Against family tradition, he decided to
go into medicine and was refused financial assistance. After
graduation from Washington University School of Medicine in
St. Louis, he was honored by an offer of a position with Harvey
Cushing at Harvard. Unable to afford the required stipend, he
remained in St. Louis to train with Vilray Blair, under whose
tutelage he thrived. Later he popularized the pharyngeal flap in
the United States, reporting results in 1930, 1936 and 1947. He
was particularly interested in its use in cleft palate cases in which
previous surgery had been unsuccessful. With Kathryn Stephen­
son in a 1948 book, Padgett stated:

When the base is downward, one can get very little length to the flap.
Therefore, we have used the flap with the base upward near the adenoid
tissue and somewhat wider and longer than shown by Rosenthal.

In reference to maintaining the palatopharyngeal synechia,
Padgett explained:

Ordinarily, the pedicle is left attached for a variable period of time and then
cut. But in 3 instances, after the pedicle has been severed, the patients
requested reattachments as speech seemed better with the pedicle at-
tached. . . . Although it may not be physiologically the ideal procedure, it
will allow one to close a very large defect of the soft palate with surprisingly good functional result.

**Sanvenero-Rosselli**

As early as 1935, Gustavo Sanvenero-Rosselli of Milan, Italy, suggested that a superiorly based pharyngeal flap be used with a Veau palate closure. This type of pharyngeal flap has become popular over the years, and 30 years after his original proposal, Sanvenero-Rosselli, at the Second Hamburg Symposium, reiterated his confidence in the superiorly based flap:

The backward and upper attraction of the velum that we obtain with the superiorly based flap is more similar to the attitude the latter assumes in normal speech conditions: the extreme portion of the soft palate remains free and mobile, the narrowing of the undue space between palate and pharynx occurs at the right level, and at the same time, also, the upper nasal resonating cavity becomes narrower.

As he said in Hamburg in 1964:

A diligent utilization of the remaining tissue, integrated with a pharyngeal flap of maximal size, offers a possibility of repair.

He diagramed his use of a superiorly based flap to close a large anterior palate fistula.

During a visit with Sanvenero-Rosselli in Milan in 1948, I was impressed with his sophistication in the handling of flaps in the operating room. Like Gillies, he was a flap man, which predilection probably explained his infatuation for pharyngeal flaps. He had great vivacity even in his later years, and when the announcement came that the Fourth International Congress of Plastic Surgery was to be held in Rome, he sprang to his feet and

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screamed at the top of his voice to the entire assembly, "Vive la Deuchia!" As David Matthews wrote of him in 1974:

Sanvenero will be remembered for the warmth of his personality, his courtesy, his impeccable good manners, his immaculate dress, his charm and his enthusiasm. It can truly be said that he was surgically an aristocrat to his fingertips.

Moran

The dapper, fiery Pete Moran, surgeon to the Washington Redskins football team, in 1948 presented cleft cases using a superiorly based pharyngeal flap, which in 1951 he reported had been found beneficial also in the congenitally short palate and the paralyzed palate.

About this time a plastic surgical meeting was being held in Washington, D.C., and Pete Moran invited a group of his friends to make rounds with him to see his favorite cases. Without Moran's knowledge, his friends got together and decided to pull his leg. To add to the pomp and ceremony, Moran, a devout Catholic, had arranged that the hospital's Mother Superior be in attendance. Rounds started and Moran showed one of his remarkable temporal decompressions for exophthalmos. The surgeons accepted the case quietly with, "We have all seen these before, Pete. What else do you have?" Moran took the group by the animal lab and showed them a dog with a skin tube pedicle attached to the canine's heart in an attempt to increase the vascularity of the myocardium. The surgeons' nonchalance was expressed with: "We've seen this before." Moran's face began to show a tinge of purple but he led the way to the next patient with a partially paralyzed palate who spoke remarkably well with the aid of a superiorly-based pharyngeal flap. He received the same: "But we all have seen this before many times, Pete." Whereupon Moran reached over and pinched the right reverend backside of the Mother Superior with "Ever seen anything like this before?"

He was requested officially to leave the hospital and, as had happened before, he ordered a fleet of ambulances and evacuated his patients to another hospital until all ruffled feathers had been settled.

In 1951 Fred Dunn of New York wrote:

From my experience, the pharyngeal flap operation described by Dr. Moran is the most important surgical contribution thus far presented in aiding speech in those cleft patients who have had their palates closed and still do not speak well.
Maverick Richard C. Webster of Brookline, Massachusetts, had an important impact on American cleft palate surgery and on pharyngeal flaps. In the middle 50's he was active in getting plastic surgeons involved in the American Association of Cleft Palate Rehabilitation, then primarily orthodontists, otolaryngologists, prosthetists and speech pathologists. The group became known as the American Cleft Palate Association, started the Cleft Palate Journal and elected Webster their president for 1962-1963. Excerpts from his reminiscences in 1976 are pertinent:

I am almost certain that it was in 1951 that I first was impressed by the pharyngeal flap procedure. Pete Moran presented material on this operation in the amphitheater at the Massachusetts General Hospital. He had 4 or 5 tape recorders and tapes demonstrating speech of patients before and after pharyngeal flap operations. Picture the scene: he has just finished telling how good the operation is and now he will show the speech results. He turns the first machine on, there is a puff of smoke and a smell of fused wires, his face gets redder than usual, he apologizes, and punches the "on" button of the second machine. Again, a crackling noise, some purple flashes, some smoke and plenty of ozone. His face gets redder; his temporal vessels begin to pulse. We hear some pungent Moranisms and he pushes the "on" button of No. 3. More of the same. The audience is mumbling, embarrassed, and some are beginning to laugh. I'm racing down the steps, trying to keep him from getting at the last machine, because I know that the amphitheater has DC current and that his tape players must be for AC current only. Just before his hand hits button No. 4, I grab his wrist and physically interpose myself between Moran and the last machine. His temporal vessels are pounding so severely that he is about to have a stroke. I explain the archaic wiring of the "old" Massachusetts General Hospital, that I have a converter, and that I will be happy to go get it. By the time I get back with it unfortunately there is no audience left. However, Dr. Moran and I listened to every tape and I heard speech results that, although not perfect, were definitely better than my push-back procedures were giving me. Pete was kind enough to spend the time explaining his operation in detail. He, like the others before him, made narrow flaps and tried to close the pharyngeal donor area.

Having done adenoid surgery and pharyngeal tumor work, I reasoned that wide flaps made from salpingo-pharyngeal fold to salpingo-pharyngeal fold would give even more effective velopharyngeal closure and that no attempt should be made to close the donor area, at least in most cases. My first procedure went well surgically, but the child had a cardiac arrest and
expired when coming out of anesthesia. Obviously, plenty of fear was
involved in doing the second and the third procedures. However, the results
were so impressive that we continued and gradually extended the procedure
to other applications.

A wider flap

In 1956 in Plastic and Reconstructive Surgery Webster, with R. J.
Coffey, J. A. Russell and L. F. Quigley of Brookline, Massachusetts,
advocated the widest pharyngeal flaps yet dared and showed little concern for the closure of the secondary defect in the pharynx.

Webster classified various pharyngeal flaps as to their base
position, inferior or superior, and their method of attachment to
the palate, edge to edge, split border, denuded edge and turnover
flap.

Quite apart from wide pharyngeal flaps with no concern for
donor area closure, Webster reminded me of his early advocacy of
primary pharyngeal flaps for
closure of non-cleft defects, supplementation in palatal paralyses, early
primary cleft closure (before Dick Stark, I believe), and in combination with
speech and orthodontic appliances, allowing deferral of hard palate cleft
closure until later in life.

More than once Webster has proved to be ahead of his time,
and some of his pioneering, which formerly met antagonism, has
now gained approval. Here is one example in which his vision led
him in a direction I feel personally was unfortunate for palate
surgery:
It was obvious that much cleft palate care in American was going to be provided through government, and certainly, here in Massachusetts, government dictation was a fact of life. Although I have never found anything more interesting or challenging than the care of the cleft lip and palate patient, knowing my own character or code, I knew that I could not function as a free man with government running the show. That is why I stopped being active in the palate field and became engaged in the surgery and medicine of appearance.

This reminds me of another free spirit, Wardill of Newcastle, who left his homeland and palate surgery because of the threat of governmental intervention. There are many examples of this withdrawal throughout medicine. Eventually, of course, it will take its toll by discouraging people who lead the way from going into medicine in the first place, to the ultimate detriment of the quality and progress of this great field.

Webster indeed started a trend toward wider pharyngeal flaps for more effective closure of the incompetent velopharyngeal aperture. As with most fads, the pendulum swings too far. Some thought it was impossible to make a pharyngeal flap too wide. However, in 1964 Stuteville and Bzoch found hyponasality in 15 out of 40 patients with wide superiorly based secondary flaps. This caused Weisman to state:

It would seem reasonable to vary the width of the flap in proportion to the shortage of tissue, favoring a narrow flap when possible. For young children our flaps were 8 to 13 mm wide, 15 to 22 mm in length.

In 1977 Ken Bzoch of the University of Florida re-emphasized the danger of the broad flap:

I am concerned about one of the regular sequelae of broad, obturating pharyngeal flaps used either as primary or secondary surgical methods. Sequelae regularly include mouth breathing. This has an adverse effect upon the muscle tone of the facial muscles and on the direction of growth of the jaws. The “adenoid facies” which results may present a greater handicap to orthodontic and facial appearance correction than any other post-surgical sequelae from palatal closure techniques. Recent observations of the Chase Type Push Back with incorporated pharyngeal flap appear much less frequently to lead to mouth breathing sequelae.
**Fishtail attachment**

In 1977 Dennis Walker of Johannesburg began using a variation in the attachment of the pharyngeal flap to the velum, slightly reminiscent of one of Webster's designs. He described his modification:

An additional manoeuvre I have started to use removes a strip of mucosa from the pharyngeal surface of the flap and inserts the double raw edge thus produced, into a slit, somewhat like a fishtail, opening right across the free back edge of the soft palate, following a curve from the tonsillar fossa and across the uvula to the other side. The raw part of the flap is then inserted and sutured as shown. The edges can be reinforced with one or two simple sutures. This procedure helps to give a bigger area of union.

In 1978 in the *British Journal of Plastic Surgery* Dan Mahler and Yoram Levy of Ben Gurion University Medical School of Negev Beer-Sheva, Israel, presented a similar method for attachment of a superiorly based pharyngeal flap. It had been used successfully without dehiscence in eight patients 4 to 7 years of age. A standard flap is elevated, held by two long sutures at its distal corners and infiltrated with saline while the distal mucosa is de-epithelialized with delicate curved sharp scissors, leaving enough dermis to protect the vascularity. With the same scissors the posterior edge of the soft palate is split, developing a pocket between the oral and nasal layers. Into this pocket the denuded pharyngeal flap is guided and fixed with four long 4-0 silk sutures.
tied on the oral side. The distal end of the flap should be close to the posterior edge of the hard palate. The edges of the distal velum are sutured to the mucosa of the sides of the pharyngeal flap.

*Middle third nasal turnback flap*

In 1963 at the Third International Congress in Washington, D.C., Harry M. Blackfield, with J. Q. Owsley, E. R. Miller and L. I. Lawson of San Francisco, presented their modification of the superiorly based pharyngeal flap. After study of normal velopharyngeal action as well as function in palates with pharyngeal flaps attached, using cinefluorography with a synchronous sound track, they altered their flap design. They split the soft palate for exposure and sutured a wide, superiorly based flap into the middle third of the nasal aspect of the soft palate after this area had been denuded by reflecting mucosal flaps backward off the soft palate. The turnback flaps were used to cover the raw undersurface of the pharyngeal flap. They concluded:

> It is hoped that higher attachment of the pharyngeal flap with its undersurface lined with mucosal flaps from the palate will reduce the shrinkage of the flaps and will provide a more normal velopharyngeal closure, by aiding the palatal excursion in a more physiologic way.

*Velar split exposure*

Wallace H. J. Chang of the University of Massachusetts, Worcester, was described by his former chief Willie White as, the only Oriental I know with a Southern accent.
In 1978 Chang suggested the use of a partial midline split of the velum for exposure. An incision through the oral mucosa and muscle, extending from the posterior edge of the hard palate to a point 2–3 mm. proximal to the base of the uvula, enables dissection of a distally-based nasal mucosal flap from the superior surface of the velum to create a recipient attachment site for a superiorly-based pharyngeal flap and to supply cover for the raw undersurface. Chang cites these advantages:

This technique allows (1) increased facility in dissection and (2) precision in the design of the flap for lateral port control. The procedure obviates an extra suture line in the lining flap, as is necessary in the standard complete palatal split technique.

The longest flap

Johanson is a virile Viking not particularly known for his surgical timidity. In 1958 he savored a triumph when he ventured all the way down the pharynx to the larynx for a pharyngeal flap which, based above, could reach forward to the alveolar cleft.

At the Second Hamburg Symposium he elaborated:

The use of posterior pharyngeal wall supplies us with very suitable tissue, bringing into the palate not only mucous membrane but also muscle tissue. . . . For that reason we raise a flap which is so long that it can reach the terminal end of the palate, just posteriorly to the incisors. We do this by pharyngotomy, and we free the larynx and go in through a lateral incision and raise the flap about 3 to 4 cm. From this approach, we close the pharyngeal wall carefully with stitches, put a stitch in the top and bring it
out through the mouth, and then perform the rest of the operation by the oral approach. You get in this way a very beautiful and well-supplied flap which is long enough to cover every defect in the palate. . . . There is enough material in the mucoperiosteal tissue to bring down to cover the oral defect. If not, then you can let the flap go up . . . and over the margin to the nasal side . . . . We always try to cover the defect in the hard palate with a bone graft so we need a lot of tissue . . . . I believe you should suture the soft palate in front over the raw base of the flap to avoid scarring of the base.

**Superior suspensory flap**

Milton Edgerton, in *Plastic and Reconstructive Surgery* in 1965, advocated the suspensory pharyngeal flap as an adjunct in correction of velopharyngeal incompetence. He justified this type of flap attachment with:

It has often been noted that elevation of a prosthetic speech bulb to a higher level in the nasopharynx will usually improve voice quality. Similarly, the use of a superior pedicle with a pharyngeal flap seems to aid speech in some patients more than an inferior pedicle.

Speech analyst W. Hardy pointed out that mobility and elevation of the soft palate normally play a major role in the formation of the diphthongs (speech sounds that change from one vowel to another on the same syllable). Thus Edgerton reasoned that in secondary cleft palates with speech problems involving a conspicuous merging of diphthongs (*cow, about, vacation*), the need exists for more elevation of the soft palate.
The suspensory pharyngeal flap is based high superiorly, includes muscle and is 3 cm. wide. It is brought through a horizontal slit on the dome of the soft palate and attached by bending its tip back 90 degrees and suturing it to a superficially denuded area on the oral surface of the soft palate.

Edgerton suggests that the muscle in the flap may lift the palate but admits:

This lifting is not consistently present and usually is seen only as a 2- to 3-mm. dimpling of the palate on swallowing.

He concluded:

At the present time this operation is suggested as of possible value in patients with long, immobile or paralyzed palates who are having difficulty with production of diphthongs in speech.

**Anteriorly superiorly based flaps**

In 1974 in the *Cleft Palate Journal* R. Massengill and N. Georgiade of Duke University proposed an anteriorly superiorly based pharyngeal flap. The design of the flap has its base at a superior level, wider than the tip and containing mucosa, fascia and muscle. A transverse curved incision 3 to 4 cm. in length is made through the soft palate, 1 cm. posterior to the hard palate. The tip of a pharyngeal flap is folded as a knuckle and drawn to the incision for attachment to the soft palate.

This procedure was carried out on 18 patients varying in age from 4 to 39 years. The results were compared with 17 standard superiorly based pharyngeal flaps and 5 inferiorly based flaps.
The authors reported:

Cinefluorographic analysis dealing with velum movement showed that the anteriorly-superiorly based group as a whole had more movement than the control group. When the oral and nasal sound pressure recordings were compared for the two groups the anteriorly-superiorly based group as previously discussed had consistently better type readings.

**Lining the superior flap**

Nobuhiko Isshiki and Masanori Morimoto of Kyoto University School of Medicine, Japan, in 1975 modified the method of lining the superiorly based flap and the method of forming its superior suspensory attachment. They folded the pharyngeal flap to minimize the postoperative scar contracture and shrinkage during the healing phase. A superiorly based flap was elevated from the posterior pharyngeal wall and folded on itself with the mucosa outside. The flap-velum connection was made through raw surfaces produced by denuding both lateral areas of the ridge fold of the flap.

The flap-velum attachment is a little complicated. The lateral portions on each side of the ridged fold of the flap were denuded to present raw areas. Two corresponding penetrating incisions on the sides of the soft palate were made. Then, with mattress sutures passing from the velum to the pharyngeal fold and back,
the knuckle of the flap was pulled into the nasal side of the soft palate until tethered by healing.

Isshiki, who received the Gould Award for laryngeal research and the Cultural Prize of the Kyoto Shim bun newspaper for clinical cleft lip and palate work, evidently accepts few boundaries. Admitting no special personal abilities in ESP and only a purely scientific approach to its understanding, he stated:

I do not find it surprising that there may be phenomena such as these which are inexplicable by our present understanding of the physical universe.

**Lateral pharyngeal port**

As Dorrance noted, Schmidt determined by experiments that speech could remain normal while there was a rubber tube with a lumen of 6 mm. between the velum and the pharyngeal wall, but when a tube of a larger lumen was inserted, speech became nasal. He concluded that the superior constrictor muscle of the pharynx was capable of overcoming a certain amount of insufficiency which, if increased beyond 6 mm., could not be controlled by this muscle.

Michael Hogan of the New York University Medical Center, first in 1971 and then in more detail in the *Cleft Palate Journal* in 1973, presented his lateral port control (L.P.C.) pharyngeal flap. Under the premises that velopharyngeal incompetence or inadequacy is the primary cause of cleft palate speech and that the velopharyngeal sphincter becomes incompetent when, after maximum contraction during connected speech, the residual nasopharyngeal orifice or port remains too large for normal speech production, Hogan turned to the literature for a gauge on the size limit of the port.

D. W. Warren, in 1964 and 1966, analyzing aerodynamic pressure-flow patterns of consonant production in normal speech, concluded that oropharyngeal air pressure began to diminish rapidly when the velopharyngeal port exceeded 10 mm. and that nasal escape of air was clearly evident at 20 mm. N. Isshiki, I. Honjow and M. Morimoto, in 1968, utilizing acoustical as well as aerodynamic techniques, found a port size of 5 mm. in diameter to be the approximate threshold for occurrence of hypernasality. L. Bjork, in 1961, utilizing basal radiographic tech-
niques, estimated that incompetence occurs with a port size of 20 mm$^2$ in area. Hogan concluded:

Thus if the velopharyngeal port is greater than 20 mm$^2$ in area during connected speech, hypernasality and nasal escape will tend to be present. The 20 mm$^2$ area thus appears to represent the threshold of velopharyngeal incompetence.

Hogan’s goal was to design an operation to construct the velopharyngeal port size during connected speech below 20 mm$^2$ in area. Success in this endeavor would give a competent sphincter, eliminating direct defect in cleft palate speech of hypernasality and nasal escape, and permit the patient and the speech therapist to eliminate the indirect speech maladjustment—pharyngeal fricatives, glottal stops, poor tongue positioning and nasal grimacing.

Hogan decided to change the standard superiorly based lined pharyngeal flap which was being used in conjunction with Veau-Wardill-Kilner palate pushback. This flap was giving the New York University surgeons 60 percent excellent results, 20 percent improvement and 20 percent no improvement. He explained that in the standard flap, if unlined or too narrow, the lateral ports became too large on account of shrinkage, as shown.

In his design of the lateral port control operation,

The lateral margins of the [wide] pharyngeal flap are sutured to the superior portion of the soft palate, laterally to the lateral pharyngeal wall almost
completely to the base of the pharyngeal flap. Port size is controlled by a measured catheter with an external diameter of 4 mm and thus positive control is exerted over the size of the port for the first time.

This series of drawings from Hogan’s 1973 L.P.C. paper shows a wide, superiorly based pharyngeal flap being lined by nasal mucosal flaps from the soft palate, as the lateral ports are reduced around a 4 mm catheter. It produced, he reported, a total port size of about 25 mm² in area (12.5 mm² + 12.5 mm²), counting on mesial movement of the lateral pharyngeal walls to obliterate the residual space. He claimed restoration of competence to the velopharyngeal mechanism in 97 percent of 93 patients with a mean age of 16 years. Aerodynamic measurements of the 91 successfully treated patients showed an average velopharyngeal patency during speech of 5.8 mm². As would be expected, hyponasality was noted, but surprisingly, Hogan remarked:

Persistent hyponasality (lasting more than 6 months) was found in 3 cases. Hyponasality lasting longer than a year called for surgical correction. A catheter passed intranasally presented the pressure area of its tip introrally to define the obliterated lateral port. Incision through this area allows the catheter to pass into the oropharynx and the catheter is left for 5 to 7 days, to allow epithelialization to insure permanent patency.

By 1976, Hogan reported:

The complications of the lateral port control procedure may include persistent hyponasality, absence of nasal respiration, snoring and excess mucus production. . . . When absent nasal respiration with concomitant mouth breathing persists for a period greater than 1 year in the growing child, consideration is given to reopening the ports. . . . One should be cautious in reestablishing the patency of the port in the growing child, as very often, with growth, patency will be established over a period of several years as the naso- and oropharynx expand in size. The only indication for operating sooner is when the patient and parent find the existing situation intolerable.

However, in the adult, when hyponasality persists for a year . . . the lateral ports should be established by the catheter technique.

Reed Dingman’s comment in the 1975 Year Book is interesting:
A 97% success rate of establishment of velopharyngeal sphincter competency by lateral port control in patients with a mean age of 16 years is highly significant.

Creating an obturator of scar with a controlled port

For the severely scarred, shrunken, shortened, non-mobile soft palate, Herfert in 1955 recommended turning a fold-back flap from the middle of the soft palate for an attachment to a pharyngeal flap. According to Perko, this left the lateral ports too large. In the 1973 *Journal of Maxillofacial Surgery*, Milivoj Perko of Zurich extended the fold-back principle across the entire width of the palate as two flaps A and B turned from the oral side of both the hard and soft palate. A wide, inferiorly based pharyngeal flap C was lifted to overlap part of flaps A and B to create a bridge of scarred tissue with remaining raw areas. It was a means of producing a non-dynamic obturator to fill partially the velopharyngeal aperture. Perko noted that this enabled him to fulfill Trauner’s 1973 challenge that the lateral ports should be 3 mm.

Design of flap width by logic

In 1967 H. L. Morris and D. C. Spriestersbach of the University of Iowa reported on the pharyngeal flap as a speech mechanism. Speakers with successful pharyngeal flaps, they said, revealed either mesial movement of the lateral pharyngeal walls or superoposterior movement of the palatal flap structure, with the mesial movement of the lateral pharyngeal walls the better predictor of pharyngeal flap success.
Thus it is logical to cut the pharyngeal flap the width necessary to fit between and touch the medial excursion of the lateral pharyngeal walls. This is the plan designed by Donnell F. Johns and Kenneth E. Salyer of the University of Texas Southwestern Medical School, Dallas. Under topical anesthesia, the medial excursion of the lateral pharyngeal walls is marked with methylene blue on the posterior pharyngeal wall. Then, under general anesthesia, incisions along these marks fashion a flap of exact dimension based superiorly above the tubercle of the atlas to fill the sphincter gap.

**Evaluation of flap attachment**

In 1977 Michael Lewin, A. Daniller, C. Croft, and R. J. Shprintzen of Montefiore Hospital, the Bronx, compared three methods of insertion of superiorly based pharyngeal flaps of similar width:

The methods of insertion were: (1) midline splitting of the velum with levator reposition and insertion of the PF into the midline split, (2) horizontal splitting of the velum along its posterior edge with insertion of the PF "sandwich" style; (3) Dorrance pushback combined with PF. Over 100 patients were examined at least 6 months postoperatively with multi-view videofluoroscopy and nasopharyngoscopy. . . . The sandwich method resulted in maximum obturation, the Dorrance with the least. The midline split method resulted in moderately wide PF.

**TIMING THE PHARYNGEAL FLAP**

At the Association meeting in Chicago in 1977, the Lancaster group of Harding, Mazaheri and Krogman, using the standard lip (3 months) and palate (18 months) closure, reported a 20 percent velopharyngeal incompetence rate. A retrospective study to see whether the failure cases could be predicted revealed that prior to three years, there were no significant morphological differences among the various cleft groups. In the cleft-palate-only group the velum was longer two years postoperatively, but between three and six years, measurable differences in length of the velum were consistent with velopharyngeal incompetence. Since speech improves as a function of maturation between ages 3 and 6, Harding and his colleagues advocated a superiorly based pharyn-
geal flap at a mean age of 6.5 years (definite V.I. at 3 to 4 years),
with over 90 percent of all patients achieving acceptable speech.

Randall rose to take issue with this timing, referring to Ralph
Hamilton’s law: *Do a pharyngeal flap the year after you should have
done it.* He advocated a pharyngeal flap at age 2 to 5 years,
favoring early operation if incompetence is severe, and later
surgery if it is borderline.

## A Hitching Post of Last Resort

Attachment of the palate to the pharynx is not natural or nature
would have prearranged for this mechanism long before surgeons
found their way to the palate. Yet time and experience have
shown that the pharyngeal flap does work to advantage in many
cases. The combination of reducing the size of the nasopharyngeal
vault, obturating some of the velopharyngeal space with the
actual flap and either dragging the palate back or holding it in its
"pushback" position contributes toward its success. Beware of
obstructing the nasal airflow as can happen with very wide
pharyngeal flaps. Not only does this unphysiological condition
cause destructive changes in the nasal mucosa and decrease lung
function, but it can be responsible for hyponasality in speech,
which may be more objectionable than mild hypernasality.
The debate over the merits of the inferior versus the superior base of a posterior pharyngeal flap has been violent and will continue to rage, even to the point of hyponasality. Schoenborn started with an inferior base but later switched to the superior one. The two Irishmen Conway and Moran, who were always fighting over something, took opposite sides on the base of a pharyngeal flap, Conway preferring the inferior base, claiming it was easier to develop and attach, while Moran championed the superior base, boasting fewer middle ear complications and easier control of postoperative bleeding. Before and since, surgeons have lined up on one side or the other. In general, the inferior base is considered easier to attach, while the superior base is touted as giving a larger flap more effective in speech improvement.

Then there are those surgeons, like Skoog, who feel that the position of the base makes no difference. In a 1965 retrospective study of 82 patients (49 flaps superiorly based, 33 inferiorly based), Skoog found it difficult to tell which was which. In 1970 M. Hamlen of Toronto reported a retrospective study of 91 patients with pharyngeal flaps (64 superiorly based and 27 inferiorly based). He was unable to demonstrate any significant difference in short- or long-term results. According to Yules and Chase:

More centers seem to be switching to superiorly based flaps—especially in difficult cases.
Fára and Vele noted in 1972:

Two autopsies, six biopsies and 154 electromyographies were the basis for a biological assessment of primary pharyngeal flaps, both superior- and inferior-based. It was determined that the inferior-based flap preserved its muscle content in a better state than did the superior-based flap, the latter demonstrating a greater degree of muscle atrophy and fibrosis. Nevertheless, the superior-based flap provided for far superior dynamic palato-pharyngeal closure than did the inferior-based flap, provided the patient has a functional nasopharyngeal musculature.

In 1972 Whitaker, Randall, Graham, Hamilton and Winchester of Philadelphia compared superiorly and inferiorly based posterior pharyngeal flaps. Seventeen superiorly based flaps were placed high on the nasal side of the soft palate. Eighteen inferiorly based flaps were inserted on the oral side, well up into the muscular part of the palate with a turnover flap of mucosa to line the raw side. A randomized evaluation of 35 patients with velopharyngeal incompetence, who had posterior pharyngeal flaps applied during 1966 through 1971, revealed 17 percent with residual "slight" incompetence but 97 percent with normal speech or with "slight" distortions. The authors stated:

There were no significant differences between superiorly and inferiorly based flaps in postoperative speech, hearing acuity, short and long term complications or length of hospital stay. Sex of the individual and extent of the cleft also did not affect the outcome. From this data it would appear that anatomic or technical considerations are therefore the only relevant factors in deciding on whether to do a superiorly or inferiorly based posterior pharyngeal flap.

In 1973 Randall, for Grabb and Smith, stated:

The inferiorly based posterior pharyngeal flap is constructed more easily than the superiorly based flap. It has the advantages of acting somewhat as a sounding board to direct the airstream into the mouth, it may well be located at a level where the greatest amount of lateral pharyngeal wall motion takes place, its construction does not require opening the soft palate repair, and it lends itself well to secondary procedures which may be needed to make the lateral openings larger or smaller.

The superiorly based posterior pharyngeal flap, on the other hand, can be raised in greater length and can bridge a larger gap. . . . Its base is located nearer the usual site of velopharyngeal closure, and as it contracts it tends to
pull the palate in this direction. To attach such a flap usually requires reopening the soft palate repair. . . . It is often difficult, even on x-ray examination, to tell the difference between superiorly and inferiorly based flaps, as each tends to approach the same point during the healing process. . . . Accordingly, my preference is usually for the inferiorly based flap, and particularly if exposure is difficult, if the patient is in poor condition, or if the palate is so mobile. . . . On the other hand, if the space to be bridged is great, a superiorly based flap must be used, or the palate would have to be lengthened at the same operation.

In 1976, at the American Cleft Palate Association meeting in San Francisco, P. Randall, with Whitaker, Noone and Jones, "rehashed" this old argument under the title "The Case for the Inferiorly Based Posterior Pharyngeal Flap." They did note that as the use of the inferiorly based flap is easier, exposure more satisfactory and time of operation shorter, it was preferred in patients with jaw deformities such as those with Treacher Collins syndrome or with Pierre Robin anomaly . . . also . . . poor operative risks . . . and poorly nourished.

Randall gave the bottom line:

If there is no demonstrable difference and some reasons pro or con, then why throw one of them away?

In 1975 Ralph Blocksma, with Leuz and Mellerstig, of Grand Rapids, Michigan, reported conservative closure of the palate with the use of mucoperiosteal flaps. The palate was closed at 18 to 24 months with a modified von Langenbeck procedure. The hard palate closure is delayed until 5 years of age. These authors reported 100 conservative closures and admitted:

Pharyngeal flaps were required in 49 of them, but these flaps caused few problems.

They expressed preference for broad, superiorly based pharyngeal flaps and obtained a large area of attachment on the nasal side of the soft palate, leaving virtually no raw area.

In 1977 Bengt Nylen of Stockholm stated his preference for the superiorly based flap, citing more tissue available and safer hemostasis as the donor area is in view and can be controlled under direct vision postoperatively, if necessary.
IMPORTANCE OF THE LEVEL OF THE BASE

Whether the base was superior or inferior did not seem to matter as much as the height of the actual base itself.

Owsley and Blackfield in 1965, Skoog in 1965, and Weber, Chase and Jobe in 1970 all emphasized the importance of maintaining the upward-posterior vector of motion of the soft palate when attaching a pharyngeal flap. The low pharyngeal flap, attached at the posterior margin of the soft palate, produces traction in an inferior or straight posterior direction and may actually restrict normal palate elevation. In 1977, at a Cleft Palate Symposium in Chicago, John Owsley recalled that in the 60's a review of 21 posterior pharyngeal flaps revealed four good speech results. The contracture of the flap and the donor area had ended with inferiorly or superiorly based flaps looking the same and showing the same downward tethering. Thus, he raised his wide flap, based higher, to an optimal position well above Passavant's pad and advanced it to the hard palate and mended levator muscles with improvement in speech to 50 percent normal and 30 percent acceptable.

DIRECTIONS OF CONTRACTURE

Although I use both inferior and superior bases, my preference has always been for the superior base. There seems to be a better donor area in infants and children with less problem of adenoid tissue. There is more natural flow of the flap to the superior nasal surface of the velum. I do not find it necessary to open the soft palate. Any contracture of whatever raw surface remains on the underbelly of the flap will tend to lift the palate up toward the normal speech contact point in the pharynx, rather than drag it downward.

DONOR AREA CONTRACTURE

Of course, the donor area also influences the eventual position of the base of the flap. Most surgeons close the pharyngeal donor area for hemostasis, and most initial donor area closures open and
heal by granulation and scar contracture. It is interesting that the contracture of the donor area pulls in the opposite direction to the raw area of the flap but in a lesser degree. The donor area scar pulls upward with an inferiorly based flap and downward with a superiorly based flap.

**BOTH BASES**

In compromise or in spite, in 1961 I designed a procedure using both superiorly and inferiorly based flaps simultaneously. The reasoning was basic. In wide clefts the insertion of a pharyngeal flap in the nasal or oral side relieves the tension of closure in only one plane. The overall tightness of a waistcoat buttoned over an obese belly will show little relief with but one good gusset in either the covering cloth or the lining if the other maintains its original dimension. Thus a vertical Z of two flaps was advocated to provide both cover and lining of a wedge to be inserted into the cleft to reduce the side-to-side tightness ordinarily present after closure of wide clefts. An important factor in this double design called for both bases to be set at the same point of potential contact between the velum and the pharyngeal wall at the time of levator action.

Thus, a vertical incision in the midline of the posterior pharyngeal wall allowed a flap to be taken on either side of it with both bases placed side by side at the midpoint, which in turn was set at the potential velar contact point during action of the levator muscle. The flap with a superior base was turned over for
nasal lining and the flap with an inferior base, composed of mucosa and varying degrees of adenoid tissue dissected with care, supplied cover on the oral side. This double flap method was used in two boys, 6 and 9 years of age, who had minimal adenoid tissue.

Since the development of the island flap, there has not been a need for this rather complicated procedure. Yet if the method were to be used today, the flaps which were originally narrower than necessary would be taken somewhat wider. In fact, Kapetansky’s later modification of the double flap principle with the flap bases turned more laterally in the hope of preserving at least one nerve is preferred.
38. Primary Pharyngeal Flap

Use of the posterior pharyngeal flap in primary cleft palate surgery was first reported by a German, Freund, in 1927. It is possible he was not the first to take this step. As early as 1924, F. Burian of Prague was using a posterior pharyngeal flap in combination with a primary palate pushback operation. In 1954, Sanvenero-Rosselli advocated a similar use of a superiorly based flap.

Richard Webster of Brookline, Massachusetts, and his co-workers in 1956 promoted the use of the primary pharyngeal flap and reported eight cases:

We have used posterior pharyngeal flaps in children 17 and 18 months old to aid in primary cleft closure when the width of the cleft and lack of palatal tissue led us to anticipate later sphincter incompetency.

Popularizing the Standard Primary Pharyngeal Flap

The one surgeon to popularize the primary pharyngeal flap in the Western world was undoubtedly Richard B. Stark. In 1960, with DeHaan, Stark published a paper with emphasis on the use of the primary pharyngeal flap. His first case, he reported, had been performed in 1954 on a 1-year-old child. By the time his book, Cleft Palate, was published in 1968, he had 60 primary flaps carried out in conjunction with a von Langenbeck procedure before speech had begun.

Stark is also a renowned artist with a precise, continuous-line style, as seen in his sketch of St. Luke’s Hospital where many of
his primary flaps were attached. His sketches of the primary pharyngeal flap technique, the palate and pharynx, the surgical design, Dott gag and anesthetic tube, gloved hands and instruments in action are, to me, some of the clearest and finest illustrations of palate surgery.

Conway, when asked in open court what he thought of the primary flap, stated:

I am opposed to its universal use in all cleft cases.

Yet Stark’s faith in this principle has been greatly responsible for what present popularity it enjoys.

Stark’s most recent thoughts on it appear in the excellent compilation *Cleft Lip and Palate*, edited by Grabb, Rosenstein and Bzoch. Out of 86 primary flap patients, 42 were 5 years of age or more and old enough for speech testing. Out of the 42, 10 were excluded because of mental retardation, flap disruptions, tracheostomy and an unrelated death. Of the remaining 32, 3 were considered excellent, 26 good, 3 fair and none with poor or unintelligible speech. This evaluation was graded on (1) volume, (2) pitch, (3) voice quality, (4) rate, (5) rhythm and (6) articulation.

Stark based the rationale behind the flap of mucosa, submucosa and superior constrictor muscle in primary repair of cleft palate on three factors:
1. In clefts of the palate (and especially those of the soft palate alone) embryologically there appears to be an inherent paucity of mesoderm, which logically requires the addition of dynamic muscular tissue plus added blood supply in the region of the uvula.

2. A pharyngoplasty is performed simultaneously by virtue of closing the pharyngeal donor defect and of elevating the flap into position.

3. The open cleft of the palate presents the plastic surgeon with the best opportunity of both elevating the flap and closing the donor defect.

Although he agrees with Skoog that whether the flap is based inferiorly or superiorly is academic and in postoperative examination it is difficult to tell which is which, Stark still prefers the inferior base for ease of application. He does admit that when a hypertrophied adenoid pad is present a superior base is better.

ANOTHER PRIMARY ADVOCATE

In 1961 James B. Cox and Bernard Silverstein of Knoxville, Tennessee, reported 78 pharyngeal flaps, 41 secondary and 37 primary. They noted that the primary flaps were usually smaller in size, were let into the nasal side, were used in association with a von Langenbeck operation and had no postoperative breakdown or fistulae. In 1972 Cox wrote to confirm his favor of the primary pharyngeal flap in the Southeastern Society’s newsletter.

I feel there is a frequent indication or need for a pharyngeal flap to augment the palate at the time of the initial repair. This feeling is based on the belief that there is a real or relative deficiency of palatal tissue in many, if not most, cases of cleft palate. . . . The midline area of the posterior pharyngeal wall fulfills the requirements of a good donor area for tissue to augment the palate, and also, the elevation of a flap from this area offers some benefit as a type of pharyngoplasty. The addition of tissue in the midline area of the palate affords . . . an easier, simpler closure. . . . Better primary healing occurs and fistulae are rare. Of considerable importance is the fact that one relatively simple operative procedure can be performed safely at an early age (twelve to eighteen months) and will provide, in most cases, an adequate mechanism for speech.

Over the past 15 years, I have performed well over one hundred cases of primary pharyngeal flaps and have been pleased with the overall results. Speech results have been . . . superior on the average to results achieved by other methods. . . . There is a higher percentage of normal speakers among this group than in comparable groups having other types of surgery. I have
not been able to detect any adverse effect on facial development, and hearing problems have been fewer and of lesser degree.

In 1977 Cox reconfirmed his earlier findings about better speech results with no deleterious effects on growth. He recalled his first primary pharyngeal flap in 1956:

My first case was a four-year-old boy with an incomplete cleft extending through the entire soft palate and about one-eighth of the hard palate. His speech was poor with typical velopharyngeal insufficiency. I used a relatively small, midline, superiorly-based pharyngeal flap incorporating the muscle and did an ordinary simple repair. This boy, without speech training, progressed reasonably soon to essentially normal speech. In 1960, I did a report on these flaps and today I am still very pleased with the results obtained over about twenty years.

AND ANOTHER

Philip A. Weisman of the Good Samaritan Hospital, Dayton, Ohio, after 10 years of experience with the standard Wardill palate procedure noted that most palates achieved normal speech but many did not. Regarding Stark’s use of a primary pharyngeal flap in all palates, he commented:

If one could select the patients most likely to have poor results with the standard technique, the primary flap could be reserved for this group alone—without using it unnecessarily for those who would not need it. Subtelny et al. observed that after a secondary pharyngeal flap, the potential for normal speech was often established but unfulfilled. With a primary flap, the batting average should be better.

Weisman chose for consideration for a primary pharyngeal flap all complete clefts, very wide incomplete clefts, clefts with shortage of tissue and unoperated older patients. He used the primary flap in 16 out of 32 palates from 1965 to 1970.

In the first stage, Weisman employed a vomer flap to close the hard palate and added a Skoog periosteal flap when closing the lip. Then his attack on the palate had a built-in belt, suspenders and hand-holding safety series which was almost an “overkill.” He combined a Wardill V-Y pushback, levator retropositioning,
Limberg ostectomy, Z-plasty of the nasal mucosa and union of the posterior pillars of the fauces well behind the uvula. Finally, onto the oral raw area of the join he sutured a high, inferiorly based pharyngeal flap! It's a little tricky to say which does what.

Of the 16 cases, eight could be evaluated and six of them were considered by Weisman to have satisfactory speech. A hyperkinetic boy on Dilantin revealed hyponasal speech postoperatively.

Weisman summarized the value of a primary pharyngeal flap:

**Disadvantages...**

1. Longer operating time (slight).
2. Greater risk of bleeding (slight).
3. Increased postoperative airway embarrassment.
4. Risk of denasality (small, surgically correctable).
5. Posterior wall compromised as future donor site.
6. Interference with future nasotracheal intubation.

**Advantages. . . .**

1. Improved chance for velopharyngeal competence during early speech development, rather than after fixation of improper habits and the emotionally traumatic embarrassment of rhinolalia.
2. Avoidance of speech therapy for many patients.
3. Avoidance of secondary surgery.
4. Easy accessibility in unrepaired child.
5. Palate unscarred by previous surgery.
6. Pushback effect secured by posterior attachment.
7. Tissue added to palate.
8. Tightening of “pharyngeal sphincter” by closure of flap donor site (“pharyngoplasty.”)

In 1976 Weisman wrote a follow-up:

Since 1965, I have repaired the least favorable cleft palates with a Wardill-type pushback in combination with an inferiorly-based pharyngeal flap attached into the post-uvula area. 24 patients have been operated between 18 and 24 months, the oldest at three and a half years. 22 of these patients are at least 3 years and 19 of the 22, or 86%, have normal or virtually normal speech. . . . Only 9 of these 24 have had speech therapy. I would like to emphasize that the pharyngeal flap is reserved for those with the worst prognosis. More favorable clefts are treated with the pushback procedure alone. In a few patients with extremely wide clefts and very skimpy palatal tissue, preliminary uvular adhesion procedures were done to stimulate some muscle function. Our patients have had a high incidence of ear troubles, but I do not think any higher than cleft palate patients without the pharyngeal flap. A few patients have been mouth-breathers . . . and some of this is probably due to the flap, but some due to the deviated septums or collapsed maxillary segments. Nevertheless, I believe the flap should not be made too wide, mostly about 1 cm. In 2 cases I did a partial release of the flap secondarily and in one, a complete release to overcome some mild denasality.

Here is an interesting little story:

Lance’s father never knew his mother was pregnant. Lance’s mother never knew his father’s last name. Lance’s mother never wanted Lance. Lance was born a handsome blond baby with light blue eyes, engaging personality and a severe cleft of the lip and palate. First couple considering adoption were discouraged by the cleft problems. Then came a couple, she a handsome blond Swede with light blue eyes, and he a research psychologist whose bilateral cleft lip had been reconstructed by George Pierce in San Francisco. The adoption came quickly and was followed by a pushback repair with
primary pharyngeal flap for Lance and a lip revision for his new father. Last clinical note, when Lance was 4, indicated no teasing at school, speaking fairly well and happy.

In 1966 Robert Pool of Michigan joined those using a pharyngeal flap primarily in the closure of the palate cleft.

AND STILL ANOTHER

At Duke University in the late 50’s the Wardill V-Y pushback operation was being used, dividing the nasal mucosa along the edge of the hard palate but with no attempt to supply nasal lining. This left a vulnerable area of one-layer closure subject to breakdown and scarring. Stalwart Robert M. Woolf recalled in 1977 that as a senior resident at Duke he devoted 30 percent of his operations on the palate to dealing with fistulae. When he started in Salt Lake City, Utah, he determined to make a change and came to the Oxford-type pushback without actual nasal release. Although creating fewer fistulae, he ended up with 32 percent of the cases requiring secondary surgery for speech improvement. Thus, in 1971, at Primary Children’s Medical Center, Woolf and Broadbent began a prophylactic campaign using a primary superiorly based pharyngeal flap to supply lining to the nasal defect of the pushback. They employed this method in 76 percent of cases with a 1 percent occurrence of fistulae and have been encouraged by the apparent improvement in speech from 50 percent acceptable results to 80 percent without evidence of other deleterious effects.

In 1977 in Chicago Ray Broadbent stated:

If 24 to 26 percent of palates will need a pharyngeal flap, do it primarily on all since you can’t tell which and it’s important to speak well early.

SIDE-TO-SIDE RELIEF

It must be admitted that in rare wide deficient clefts of the palate a primary pharyngeal flap can bring in extra tissue. Usually there are better ways of accomplishing this goal, but in 1962, in Plastic and Reconstructive Surgery, I suggested a slight variation, which
can be used to relieve moderately the side-to-side tension of cleft closure. By turning edge flaps orally and inserting a superiorly based pharyngeal flap nasally, one can bring some extra tissue to both the oral and nasal lining.

During this same 1962 presentation, two other methods were described to facilitate further side-to-side relief during closure of wide clefts with a primary pharyngeal flap. One involved taking a longitudinal vomerine mucoperiosteal flap based posteriorly for the nasal closure of the soft palate cleft, and a superiorly based pharyngeal flap twisted for closure of the oral side. This procedure has not been used since that time, as the vomerine mucoperiosteum has more valuable functions.

The second method, described in Chapter 37, involved two parallel posterior pharyngeal flaps, one based superiorly, to be inserted into the nasal side of the soft palate cleft, the other based inferiorly, for the oral side.
OCCASIONAL PRIMARY FLAP

Bengt Nylén of Stockholm, the Venice of the North, is an international sailor whose Cal 40 was the leading European boat in the 1968 transatlantic race. In 1977 Nylén explained that he still uses the pharyngeal flap that Skoog taught him in 1955, inserting it at 5 to 6 years of age in about 11 percent of cases. He also uses this flap as a primary procedure:

Occasionally, we use this flap primarily in cases operated at 12 to 18 months. We do it when the nasal surface is difficult to suture. In a case like the one diagrammed, with an unoperated cleft of the secondary palate, the flap is usually 6 to 8 cm. long, based at the level of the eustachian tube openings and consisting of muscle and mucosa. I don't suture the donor site. Added to the pharyngeal flap I've used small mucosal flaps from the posterior nasal surface of the soft palate to cover the raw surface of the flap. The advantages are good nasal cover and the addition of a lot of tissue, including muscle, to the soft palate. At the same time you decrease the nasal gate with the base of the flap and reduce the risk of open nasality.

OPPOSITION TO PRIMARY FLAP

Probably the majority of palate surgeons do not favor primary pharyngeal flaps except in unusual circumstances. R. N. Sharma of Lucknow, India, who was trained in England and uses the Veau-Kilner-Wardill pharyngoplasty, wrote in 1966:

Pharyngoplasty as a primary procedure in early age groups is not justifiable but it may be combined if repair is undertaken after five years of age.
K. M. Cleveland and M. L. Falk of Detroit noted in 1970 that from their study the postalveolar cleft, congenitally short palate and submucous cleft tended to necessitate pharyngeal flap surgery, whereas unilateral complete clefts treated with V-Y four-flap closure were likely to achieve normal speech without a pharyngeal flap adjunct. They also found that when primary closure was performed at the mean age of approximately 7 months, adequate speech without a pharyngeal flap was common. From these data they concluded:

Pharyngeal flap surgery should not necessarily be part of the total primary repair procedure since some types of clefts, in combination with certain procedures, will result in normal speech.

**JUSTIFICATION OF PRIMARY PHARYNGEAL FLAP**

Hal Bingham while at Columbia, Missouri, with P. Suthunyarat, S. Richards and M. Graham asked the question

Should the pharyngeal flap be used primarily with palatoplasty?

and answered it in 1972 after he arrived at the University of Florida, Gainesville:

In certain selected cleft problems, palatoplasty with a primary pharyngeal flap seems indicated. The selection is made at the time of operation and relates to the amount of tension on the closure as well as palatal length.

Out of 50 cases, they elected primary posterior pharyngeal flaps 22 times, more commonly in complete clefts. Comparison of 20 V-Y palatoplasties, 10 with primary pharyngeal flaps and 10 without, showed less hearing loss and less hypernasality in the pharyngeal flap group.

A factor concerning Bingham was the two- to three-year delay between speech development and surgery, when valuable time had been lost and ingrained speech errors required intensive therapy, a dental prosthesis, or both.

In 1973 John Curtin, with Joanne Subtelny, Nobuo Oya and Daniel Subtelny, reported postoperative results of pharyngeal flap surgery employed as a primary and as a secondary procedure for
20 posterior cleft palate patients. Statistical comparisons of speech, intraoral air pressure, nasal airflow and cephalometric measures showed that the results of flap surgery as primary and secondary procedures could not be differentiated. The findings suggested to the authors that pharyngeal flaps may be indicated in preadolescent and older patients with unoperated posterior clefts, when adequacy of velar tissue for functional closure is questionable.

David Furnas of the University of California, Irvine, endorsed the primary pharyngeal flap in certain cases when he wrote in 1977:

In recent years I have been doing primary pharyngeal flaps at the time of my palate repair in any patient where a short palate was expected. The pharyngeal flap is an inelegant, unphysiological, and tedious procedure, but pragmatically it has given me excellent results (but I'm still not satisfied—denasal speech is sometimes a problem).

Also in 1977, Randall advocated a primary pharyngeal flap for the horseshoe-type cleft with poor musculature.

**PRIMARY VELOPHARYNGEAL ADHESION**

In 1975, at the Sixth International Congress in Paris, and later in its Transactions, Rudolf K. Stellmach of the Free University of Berlin noted that the normal child learns to speak well spontaneously whereas the cleft palate child often does not. He accused the short postoperative velum of being the cause of velopharyngeal incompetence, requiring one out of two patients to receive speech therapy before school age, even if the palate was closed before 2 years. This situation challenged Stellmach to look for a better method of primary palate closure. He ruled out the inferiorly based primary pharyngeal flap proposed by Stark as an unphysiological procedure better suited to secondary operation. He reasoned that if the pharyngoplasty were performed only to facilitate the otherwise normal velopharyngeal mechanism it would indeed be a primary speech-aiding operation. He set these requirements:

1. no immobility of pharyngeal wall caused by scarring as with wide flaps and secondary healing
2. the entrance to the epipharynx and the nasal airways must be wide;
3. the connection between velum and pharyngeal wall must be reversible.

The hard palate in total clefts is closed first, at 18 months, by his square vomer flap. Then at 24 to 30 months a standard V-Y palate closure is combined with a miniflap from the posterior pharyngeal wall based superiorly, measuring 5 mm. wide and 15 to 20 mm. long. It is incorporated into the nasal closure, and the donor area is closed and heals without scarring.

Stellmach reported 38 miniflaps, 22 of which were followed for three or more years. Only two children with slight nasal escape required speech therapy. He concluded:

A small adhesion of the velum to the pharynx . . . does not add considerable difficulties to the palate repair nor does it change the anatomy and normal function of the velum or the pharynx muscles. It acts to simply bring the velum close to the pharyngeal wall by traction on the bridging flap and to prevent any tendency to relapse anteriorly.

If necessary the adhesion bridge can be divided later on. This might occur around school age if adenotomy has to be performed. If velopharyngeal closure was competent for two or more years there is little danger of nasality afterwards. Three cases treated in this way did not show any decrease of speech quality. The adhesion principle is useful in all cleft palate cases, which by clinical judgment do not show sufficient velum lengthening under operation.

TO FLAP OR NOT TO FLAP
PRIMARILY

During the last two decades there has been and continues to be a worldwide epidemic of pharyngeal flaps which was boosted by R. B. Stark's advocacy of the 100 percent use of this flap primarily. In a 1960 editorial Ivy appealed for clarification of the indications and contraindications of these flaps.

As I said in 1962 and still advocate today:

Certainly, "shotgun" therapy of palate clefts with a load of posterior pharyngeal flaps without selection seems unwarranted. It is suggested, however, that in wide palate clefts, pharyngeal flaps may be indicated primarily.

Stellmach's miniflap has some appeal and at small cost for the deserving case.

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39. Forward Projection of the Pharyngeal Wall by Flaps

In 1876 Rutenberg proposed that the pharyngeal wall be brought forward to enable it to be reached by the velum. A transverse incision in the posterior pharyngeal wall, when closed with sutures longitudinally, produced a projecting ridge and narrowed the pharynx.

Passavant Again

In 1878 Passavant condemned all his previous operations and devised another for the correction of velopharyngeal insufficiency. He developed a quadrilateral flap on the posterior wall of the pharynx medial to and above the level of the Eustachian tubes, its base connecting with the mucous membrane covering the superior constrictor muscle. This flap was elevated and folded on itself to create a shelf-like projection, the sides of which were united by suture to corresponding areas on the lateral walls of the pharynx. Here was an attempt by Passavant to out-Passavant Passavant’s pad. Unfortunately, the shelf flattened out in time.

Augmenting Passavant’s Ridge

As Wardill of Newcastle upon Tyne once stated:

On examination of almost any unoperated cleft palate during the pronunciation of “ah” with the mouth wide open, a prominent ridge is seen running transversely across the posterior pharyngeal wall to appear into the upper reaches of the soft palate. ... Passavant was the first to describe this. ... With the help of my colleague, Mr. James Whillis, the superior
constrictor muscle has been shown to arise not only from the usually described situation, but also from the palatal aponeurosis.

In 1930 Whillis suggested that the most suitable name for this muscle is palatopharyngeal-sphincter, as its action appears to be assisting in shutting off the nasopharynx by producing the ridge of Passavant on the posterior pharyngeal wall.

**WARDILL**

In 1927 Wardill advocated a pharyngoplasty similar to that of Rutenberg which was designed to increase the forward effectiveness of this superior constrictor muscle ridge. As he wrote:

The pharynx is stimulated and the position of the ridge of Passavant is noted. With a fine tenotome, the mucous membrane is incised transversely at the level of the ridge over the anterior arch of the atlas through the superior constrictor muscle.

He freed this muscle from the buccopharyngeal fascia, extended the incision laterally as far as the salpingopharyngeus muscles and closed the horizontal incision in the vertical direction, thus achieving a ridge. At this time Wardill used merely relaxing incisions for his cleft closure.

In an overt gesture against British socialized medicine, Wardill migrated to Baghdad where Steffensen found him and made some pertinent inquiries. When asked, "Why not omit the pharyngoplasty in some cases?" Wardill responded with his typical, dogmatic logic:

In some cases this might be reasonable, but having gone through the time when about one percent of successful speech results was the rule, I am hesitant to discard a well-tried procedure which, to my knowledge, has never done any harm.

Gillies occasionally used the Rutenberg-Wardill pharyngoplasty. As he said:

This procedure is an application of the principle of bringing the mountain to Mahomet.

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He cited an example of one case in which a Gillies-Fry push-back plus a Rutenberg-Wardill push-forward pharyngoplasty produced 100 percent normal speech:

The Wardill pharyngoplasty brought her pharynx forward in a definite ridge which is present today.

In 1947 Bentley, using the Wardill method in 87 cases, but 41 with Wardill’s pharyngoplasty and 46 without, revealed a slight superiority with pharyngoplasty. His report showed that, without speech therapy, there were 36 perfect speech results in each category. There was imperfect speech in 10 without and in only five with pharyngoplasty.

HYNES

Wilfred Hynes, trained by Gillies at Rooksdown House and head of FHMS 5 in Italy in World War II, developed an outstanding plastic-jaw unit nestling on a hill overlooking a little stream and woods on the outskirts of the great industrial steel city of Sheffield. With basic physiology and good common sense, which tempered him as strong as Sheffield steel, Hynes made contributions to plastic surgery. In fact, in 1950 he advocated a modified bilateral pharyngeal flap to produce forward projection of the pharyngeal wall. He raised vertical mucomuscular pedicles based superiorly, incorporating each salpingopharyngeus muscle. By transposing them 90 degrees, he slid them side by side to overlap each other under slight tension and sutured them into a horizontal incision through mucosa across the posterior pharynx. This maneuver created a prominent, (what was hoped to be) permanent and often contractile shelf above Passavant’s ridge to act as the posterior wall of the palatopharyngeal sphincter. Hynes emphasized that closing the donor defects had reduced the transverse pharyngeal diameter, with an improvement in the pitch of the voice. He used his pharyngoplasty in conjunction with a V-Y palate closure and advised that it not be undertaken before the age of 10 years.
Each year Hynes ventured from his inaccessible unit on a pilgrimage to see what other plastic units were doing and to report on his own work. In 1952 he had just developed his pharyngoplasty and, on his annual jaunt, he called on Gillies at Harley Street and offered to demonstrate his operation at Dollis Hill Hospital, one of Sir Harold’s old haunts. I had the good fortune to be allowed to accompany Gillies to observe Hynes in action.

After approving the Wardill-type pharyngoplasty as an adjunct in certain cases, Gillies added:

It is probable that the new, more positive Hynes pharyngoplasty will take its place.

In 1957, in *The Principles and Art of Plastic Surgery*, Gillies and I summarized:

So, whether the palate is Dorranced, Wardilled, Browned, or Gillies-Fried, with or without a tube pedicle, it still may be bolstered from be-Hyned.

A comparison

Williams and Woolhouse of Montreal in 1962 compared the results in 24 cases. In 12 a Hynes pharyngoplasty was performed and in 12 a lower-based pharyngeal flap was used. Oral manometer readings were considered to correlate very well with speech results. Williams and Woolhouse recommended the Hynes procedure in cases in which there was a minor degree of velopharyngeal incompetence.

Refinements

In 1967 Hynes clarified the recent developments of his operation. First, the entire bulk of the lateral pharyngeal muscles, including
superior constrictor, palatopharyngeus and salpingopharyngeus, was incorporated in the flaps:

The two lateral flaps are then transposed upwards and inwards and are inset into a defect high across the posterior pharyngeal wall made by a transverse mucosal incision just below the level of the Eustachian region. [One of these flaps is set into the transverse incision and the second flap overlaps the first to form a bulky (tube pedicle-like) ridge.]

Hynes emphasized more at this time the inward advancement of the mucomuscular flaps and the narrowing of the pharynx with the closure of the donor areas. He insisted that actual closure of such large donor areas permanently obliterates the pharyngeal recesses extending laterally behind the posterior pillars of the fauces (shaded areas). This is an especially beneficial outcome in the “failed cleft palate” with the “enlarged static pharynx,” which, in spite of palate lengthening, continues to leak speech into the nose. As he wrote:

Thus, two synergistic slings have been created—a posterior element formed by the posterior pharyngeal ridge of the pharyngoplasty and an anterior element formed by the repaired velum.

Hynes did not advocate a primary pharyngoplasty for all clefts of the palate. He did prefer his “two-in-one” operation of V-Y pushback and Hynes pharyngoplasty in clefts of the soft palate only and in longer, wider clefts with less tissue to work with in constructing a competent velopharyngeal sphincter.

Although the Hynes pharyngoplasty was used all over the world, it became extremely popular in Britain for a couple of decades.

J. P. Reidy of London, an ardent apostle of Kilner, in 1964 gave his conclusions on pharyngoplasty and speech:

1. Where adequate palate repair is undertaken at 1 year, there is no indication for pharyngoplasty as well at that age.
2. Pharyngoplasty is indicated as a “supportive” operation only when the result of the palate repair can be assessed (5 years plus), and where the speech result proves disappointing.
3. The figure of 171 pharyngoplasties in 944 cases applies to the known speech results up to April 1963. It follows that with follow-up of the more recent primary cases, pharyngoplasty may well be necessary in some.

4. The Hynes pharyngoplasty has proved to be the most satisfactory.

I wrote to Hynes in 1971 and he responded:

About my pharyngoplasty, I well remember Sir Harold Gillies assisting me in a case some 20 years ago. The operation was done at the Dollis Hill Hospital, which as far as I remember, was a private concern—at least the patient was a private one. She was Miss McDonald whom I did not see before or after the operation and I suppose Sir Harold, pre-occupied at the time, forgot about asking me to see the patient again. I am, therefore, unaware of what he thought of the result or indeed of the operation. I can say, however, that the late Professor Kilner and his team accepted the operation with enthusiasm to the extent that they practiced this procedure extensively—and still do.

I recall 3 interesting incidents:

No. 1 I was approached by a cleft palate patient of 75 years of age, who demanded a pharyngoplasty so that he could at least utter one word correctly before he died. I need hardly say he died without the operation or realizing his ambition.

No. 2 I was approached by one middle-aged patient who wanted a cleft palate operation for cosmetic reasons. He was inclined to laugh rather easily and felt his mirth inhibited because of his fear of showing the very wide cleft in the roof of his mouth. I have never had any other request for a cleft palate operation for cosmetic reasons.

No. 3 I operated on a young parson, who was in fact a son of a Bishop, under rather pathetic circumstances. He had an insane desire to be a parson, I can say insane not because it is foolish to do this sort of thing, but because he wished to follow a profession where a good speaking and carrying voice is essential. He spoke reasonably well but could not project his voice far enough for the congregation in a normal-sized church to catch what he said. He was in fact traveling the country looking for a living with a church small enough to suit his diminished capacity.

Hynes concluded:

To the day I retired, I practiced my particular operation and was satisfied with the results. I never did the rival pharyngeal operation, so I am unable to compare the two procedures. However, I am quite convinced that my operation is the only one that meets the requirements of a patient whose pharynx shows reduced lateral movements as the lateral pharyngeal recesses are completely obliterated by my operation. Interestingly enough, my son,
D. M. Hynes of McMaster University, Hamilton, Ontario, Canada, worked out a radiological method of demonstrating the movements of the oro-pharynx and wrote it in *Clinical Radiology* in 1970.

In 1976 Joss of Norwich, England, wrote:

My colleague here, Frank Innes, uses a pharyngoplasty by Hynes, but there are very few people who use this method now.

Also in 1976, Innes wrote to explain his approval of the Hynes pharyngoplasty:

When the pharynx is too deep and too broad from side to side, the term "cavernous" is frequently appropriate: the best possible pushback of the soft palate will not achieve competent closure of the isthmus. An operation to bring the posterior wall of the pharynx forward and at the same time, to narrow the lateral dimension of the pharynx is required.

Wilfred Hynes of Sheffield showed us that this could be done. His pharyngoplasty (Hynes 1950) is another admirable application of basic plastic surgery principles. . . . The flaps should, however, be as thick as possible. . . . Hynes at first thought his pharyngoplasty ought to be introduced in the primary repair of clefts in young children, but I am sure that this is not necessary. The soft palate makes contact with the pharynx at a very high level in young children and I doubt if the Hynes pharyngoplasty eminence can be placed high enough to be effective in such young patients. . . . The Hynes operation works well only when the palate is effectively elongated.

Like a number of other surgeons, I have always felt that the shelf created by this pharyngoplasty would tend to flatten appreciably in time. In fact, some would say it had as much chance of standing up for any length of time as a sand castle against the incoming tide. This assessment was more true of the original design and less true after Hynes thickened his flaps and almost tubed them to each other. The additional advantage of reduction of the lateral pharyngeal recesses must not be discounted.

**CONSTRUCTING A SPHINCTERIC MEMBRANE**

Another intriguing use of the posterior pillar flaps has been developed by Miguel Orticochea, of pure Basque descent, born in
Montevideo, Uruguay, trained by Pitanguy in Rio and now running on “his own motor” in Bogotá. In 1970, in the British Journal of Plastic Surgery, Orticochea reported that for 11 years he had been closing the palate by simple approximation with sutures at 2 years of age. Six months later, at 2½, he cut the posterior pillars of the fauces, carrying the total palatopharyngeus muscles as two long rectangular flaps with superior bases. An inferiorly based pharyngeal flap, 1 X 2 cm., was elevated at the level of the tonsil, and the two pillar flaps were stitched side by side to the pharyngeal flap with U sutures. He compared this palatopharyngeus muscle transplant to the various muscle transplants effective in the hand and foot. Evolution of this sphincter over the next few months closed off the lateral spaces, resulting in a dilating-contracting circular hole, like the “diaphragm of a camera.” Orticochea claimed that this sphincter in the membrane develops better, the younger the patient is at the time of the operation. He also stated:

Nevertheless, all the patients who presented with open rhinolalia before surgery, improved to a greater or lesser degree with the construction of the sphincter.

The vagueness of his report prompted me to quiz Orticochea during his “sphincteric” lecture to my residents in Miami in 1971. As he speaks little English, his presentation was interpreted by a capable Spanish-speaking E.N.T. resident. This situation, along with Orticochea’s tendency to use such words as all, always and never, introduced a number of uncontrollable variables. Our discussion went as follows:

My first question:

“Miguel, do you always use this operation on all of your palates?”

“Yes. Ninety percent of Latin Americans with cleft palate have velopharyngeal incompetence. During 17 years of my practice in cleft lip and palate work, I have seen only two cases of direct suturing of the palate which functioned with competence, one in Buenos Aires and one in Bogotá. The Spanish language has only three nasal phonetics and the Latin American palates all are short with wide nasopharyngeal apertures. For this reason I use this sphincteric procedure in all cases. In certain cases when the flaps will
not reach, then the operation is done in two stages. If I lived in the United States, then I would use this operation only on incompetent cases.

"Do you ever have failure of closure in the lateral holes?"

"Never! They are always closed in a few weeks."

"Does fluid collect in the shelf behind your sphincter?"

"No, because the motion of the sphincter prevents the collection of fluid."

"Does this affect tonsillectomy?"

"The tonsils can be removed at any time."

"Here is an important case," he emphasized, as a slide was projected of a palate with velopharyngeal incompetence in which the patient was saying "ah." The posterior pillars of the fauces could be seen trying valiantly to make parallel approximation to each other but with a centimeter of failure.

My final question:

"What is your percentage of good speech results?"

"That is difficult to answer. I have no statistics."

It should be noted that Ortichochea is an active and exciting innovator. Although I have found several of his ideas lacking in principle, there are some that have been important and have started a new trend (musculocutaneous flap). His variation in the use of bilateral pillar flaps sparked other modifications.

Amiable Heinz Reichert of Stuttgart, in the *Journal of Maxillofacial Surgery*, 1974, described a lateral velopharyngoplasty which he feels is an improvement over the Orticochea procedure, both in principle and in technique. He explains concisely:

Using a Z-plasty, the lateral base of the pharyngopalatine arch is swung over upwardly and inwardly in exchange for a mucosal flap from the posterior pharyngeal wall. The palatopharyngeal muscle is thus transformed into an oval muscle sphincter, which actively closes the nasopharynx... The application of the principles of Z-plasty ensures that no raw surfaces remain postoperatively, and that healing occurs fast and without complication.
Reichert reported having used this procedure with success in three patients, noting that indication for the operation was limited to secondary scarred palates with poorly developed muscles.

Angel Heller of the Dentistry National University of Cordoba, Argentina, trained by Schuchardt, presented a modification of the pharyngoplasty of Orticochea in the 1975 *Journal of Maxillofacial Surgery*. He had found that in the Orticochea pharyngoplasty the sphincter closure showed a tendency to form a circular opening, the lumen of which was not always narrowed in sound function. Heller's variation developed bilateral palatopharyngeal flaps, based superiorly, which are cut from the posterior pillars. A transverse incision in the posterior pharyngeal wall made it possible to dissect a pocket. The two dangling palatopharyngeal flaps, with their mucosal surfaces back to back, were tucked into the pocket with a mattress suture. Thus, velar closure was achieved in an anteroposterior direction by a transverse closure so that a sphincter action could be more effective.

Since 1968 Heller has performed 22 of these pharyngoplasties with his "crossed" palatopharyngeal flaps. He noted:

1. The double flap takes well in the surgical pocket where it is placed.
2. It is an easily performed technique with rapid, uncomplicated healing.
3. An active muscular closure is achieved during speech, with positive intrabuccal pressure.
4. The sphincteric closure is effective during deglution, even when the flaps do not contain enough muscular fibres.
5. The nasopharyngeal closure may be perfect with a positive intranasal pressure and permits a free flow of air during muscular relaxation, which as
a result of the type of flap and its "scissors" mechanism, facilitates nasal secretion flow.

6. Even when dynamic muscular activity is not achieved in the secondary palatoplasties, the intercrossing of flaps proves to be an effective sphincteric closure.

In 1977, in *Plastic and Reconstructive Surgery*, Ian Jackson and John Silverton of Canniesburn Hospital, Glasgow, presented their modification of Orticochea's operation as a secondary procedure. Two lateral flaps of postfaucial pillars, including the underlying palatopharyngeus muscles, were cut free, sutured to each other end on end and then tucked under a wide, superiorly based pharyngeal flap to create a very bulky transverse roll on the posterior pharyngeal wall.

Of 100 cases, 74 have had at least one year follow-up, and speech results were reported to be 90 percent improved: 47 percent with no nasal escape; 23 percent with hyponasal speech at 3 months but none at 1 year; 4 percent with persistent hyponasal speech. In the six cases which had failed with the conventional pharyngeal flap, all showed improvement. Advantages of this sphincter pharyngoplasty were: (1) easy procedure, (2) velum not disturbed, (3) shrinkage less with contracture merely reducing the heart-shaped V.P. aperture, (4) less tethering during maxillary advancement, and (5) secondary adjustments possible.
40. Search for Dynamic Pharyngeal Flaps

**STANDARD** pharyngeal flaps offer various passive advantages to an incompetent velopharyngeal sphincter. They act as a posterior velar tether and tractor, offer their substance as an obturator and, with donor area closure, reduce the size of the pharyngeal aperture.

There were surgeons who were concerned about violating the posterior pharyngeal wall musculature. Randell Champion of Manchester, England, for instance, wrote in 1957:

> The pharyngeal muscles should be left undisturbed, as much as possible and if a pharyngoplasty operation is undertaken, the mucous membrane only should be used.

This, of course, removed any slight chance of flap contractile ability. Almost as long as pharyngeal flaps have been in use, surgeons have enjoyed wishful thinking that the constrictor muscle fibers, usually incorporated in these flaps, were capable of full cooperation and active contraction to lift the velum toward the pharyngeal wall during speech.

In 1959 Broadbent and Swinyard postulated that the pharyngeal flap is a dynamic structure, as demonstrated by electromyographic findings in patients in whom either superiorly or inferiorly based pharyngeal flaps had been used. By means of monopolar EMG needles inserted through the palate in the area of the flap, they observed normal motor unit potentials during swallowing. In 1972 Fára and Vele reported their EMG findings in a large series of inferiorly and superiorly based pharyngeal flaps.
Inferiorly based flaps tended to preserve their nerve supply and therefore their EMG activity, whereas superiorly based flaps were likely to become denervated.

In 1971 Smith and Dedo, in dog dissections, found the nerve supply to the superior pharyngeal constrictor muscles. It enters at the midpoint of the lateral margin and thus would be divided during the development of any vertical pharyngeal flap whether the base was superior or inferior. In 1972 Owsley, Creech and Dedo performed clinical EMG studies in the operating room on anesthetized patients undergoing superiorly based pharyngeal flap operations. They concluded that the findings in humans and in dogs were similar:

After both lateral incisions and division of the inferior end of the flap had been completed, the flap was elevated. Following this, we were unable to demonstrate any EMG potentials at any location in the flap.

Then there was the minor matter of muscle fiber direction. Weber, Jobe and Chase noted in 1970:

Dynamic muscular contracture is also said to occur in pharyngeal flaps... Since the muscle fibers are aligned transversely, it seems unlikely that contraction of the muscle would shorten the flap.

THE INNERVATED CHEVRON FLAP

Fred McCoy and Carroll Zahorsky of the University of Missouri School of Medicine, Kansas City, became interested in the possible dynamic action of the posterior pharyngeal flap. In an attempt to duplicate the 1959 electromyographic studies by Broadbent and Swinyard, which had indicated dynamic pharyngeal flaps with potentially functioning muscle, they tested their own pharyngeal flaps, taking elaborate precautions to avoid stimulation to any musculature adjacent to the flaps. They stated:

Contractility was not demonstrated in any of the patients we tested.

Their subsequent dissection of five cadavers to determine the exact pathways of innervation led to their 1972 design of a new type of pharyngeal flap, presented in Plastic and Reconstructive Surgery. This is their anatomical report:
Entering the skull, the vagus and glossopharyngeal nerves were identified as they emerged from the medulla and passed through the jugular foramen, along with the internal carotid artery. At this point, small branches from IX and from the ganglion nodosum joined a single branch from the vagus to form a branch which descended first, then turned medially and upward, paralleling the oblique fibers of the constrictor muscle. The level at which this major recurrent branching consistently occurred was about one or two centimeters above the level of the greater cornu of the hyoid bone. This branch supplied the middle and superior constrictor muscles.

In their course, these paired nerves passed downward in an extremely lateral position deep to the musculature, then turned abruptly medially and upward in a recurrent pattern to enter the deep surface of the muscles.

They deduced:

It seems apparent that the incisions for all the conventional pharyngeal flaps would completely sever this nerve supply, particularly the incisions for those flaps based superiorly. There is a possibility that an inferiorly-based flap, placed high enough, might retain some functioning neuromuscular units.

McCoy is a big-game hunter with trophies of polar bear from the Arctic, elk from the Rockies and elephant from Tanzania. He now feels that use of the dwindling numbers of fascinating species should be restricted to the shooting of specimens for museum collections, where the lessons of ethology can be best taught—possibly for the eventual survival of civilization. Here McCoy, with the shoulder patch insignia of the Kansas City Museum of History and Science, is preparing to measure an impala prior to mounting for the Museum.

Whether he is hunting bobwhite or bobcat, the same instincts that prompt McCoy's charting of direction during a tracking, taking into account specific wind and terrain factors, must have led him, in his hunt for a dynamic pharyngeal flap, to shift the direction of its axis to a transverse chevron-shaped bipedicle flap:

The incisions are made through the mucosa and musculature, and the flap is elevated carefully from the prevertebral fascia to avoid damage to the nerve supply, just deep to the muscle.

An area of 8 to 10 mm. of the mucosa at the apex is denuded to allow its insertion under a flap on the nasal surface of the soft palate. This latter 1 cm. flap is based posteriorly and is raised just 1 cm. anterior to the posterior border of the soft palate.
The chevron flap is then pulled into position so that the two raw surfaces directly overlie one another. The 3 layers are then fixed with 5 through-and-through chromic catgut sutures. The donor defect can only be partially closed by undermining an advancement of the wound edges. The remaining defect heals secondarily without difficulty within 10 to 14 days.

At the time of the 1972 presentation, McCoy and Zahorsky had used this flap on five secondary cleft palate patients over a six-month period. All five showed an improvement, and one showed functional neurovascular components within the pedicles when tested electromyographically. In spite of the limited experience, these advantages were outlined:

1. A chevron-shaped, bipedicled flap, properly placed, can produce a dynamic neurovascular unit.
2. The two-directional pull, or "bridle effect," gives added effectiveness to the velopharyngeal closure.
3. The double pedicle fills twice the space filled by a single-pedicled flap.
4. There is a more natural central nasopharyngeal opening for mucous drainage.
5. There is no damage to that portion of the superior constrictor muscle involved in Passavant's ridge formation.
6. It may be possible to secondarily use this flap following the use of an inadequate superiorly-based flap.

In 1976 McCoy summarized his present stand:

Our development of this flap stemmed from our basic concern for the possible importance of a dynamically functioning pharyngeal flap. We shared Ray Broadbent's concept that dynamism is a highly desirable feature. We did not share his confidence that this was being obtained in his superiorly
based flaps. The same objections applied to those based inferiorly. Our suspicion was confirmed by anatomical dissections. . . . Actually, once the anatomical distribution of the nerve supply had been identified, the chevron flap virtually designed itself. Since 1971, we have used the chevron flap almost exclusively, with only an occasional superiorly based flap being used for comparison. Our speech therapists have been enthusiastic from the outset about the improved results, which in many instances were dramatic.

We are currently engaged in a five-year re-evaluation, not only of the improvement of the quality in speech, but also of the question of dynamism on these flaps. We have now done approximately 60 chevron flaps and continue to do them exactly as originally described. The complications have been rare and the two technical failures were probably due to the inexperience of the resident operators. Like most other pharyngeal flaps, we feel they should be done at an early age, preferably under 6, and have been least effective in patients over 16.

In 1973 in Plastic and Reconstructive Surgery Donald I. Kape­tansky of Southfield, Michigan, reported his bilateral transverse pharyngeal flaps for velopharyngeal incompetence. This procedure, he explained, was developed to preserve the muscular function in healed pharyngeal flaps as he had noted gradual atrophy in “our series of 225 pharyngeal flaps during the past 14 years.” The operation was designed to produce two smaller competent pharyngeal sphincters, in place of the single large incompetent sphincter. His description of the method is clear:

A wide S-shaped incision is made on the posterior pharyngeal wall to produce two flaps, each having a base of 15 to 20 mm with a length of 30 to 35 mm. The incisions are deepened to the prevertebral fascia (to preserve any nerve supply entering on the deep aspect of the muscle tissue [McCoy and Zahorsky]).
Usually the flaps can be inserted into the posterior 15 to 20 mm of the midportion of the soft palate. One flap is brought up to the nasal aspect—where it is turned on its long axis and fastened in place with interrupted, braided, non-absorbable sutures. The opposite flap is brought up to cover the oral aspect in the same position. A few interrupted sutures are used then to bring the two flaps together in the posterior midline area.

The residual defect in the posterior pharyngeal wall is closed with a few sutures which also pick up the deep fascia to avoid tenting of the tissues.

At the time of this first publication, Kapetansky had used double flaps on 21 patients over the preceding year.

By 1975 he had carried out 48 double-pedicle posterior pharyngeal flaps in patients ranging from 5 to 30 years. Thirty-nine had not had a pharyngeal flap before, but nine had had either an inferiorly or a superiorly based flap which failed to produce acceptable speech. One double flap separated, but dramatic improvement in speech was noted in the remaining 47 patients.

In his 1975 report in the Cleft Palate Journal, Kapetansky presented rough sketches showing (A) an incompetent palato-pharyngeal sphincter, (B) the formation of two sphincters with his double-pedicle procedure, (C) partial sphincter functioning during speech and (D) complete sphincter functioning during speech and swallowing.

He emphasized that the preservation of the nerve supply not only maintained a larger flap mass for better obturator effect but enhanced the flap’s contractile possibilities.

In 1975 Kapetansky forwarded to me three different problem cases of rhinolalia which had been completely corrected with his transverse pharyngeal flap operation:

A. Before

A. After

A. W. M.—Nine-year-old male born with a cleft of the palate, post-alveolar, with repair at eighteen months of age by another surgeon. In 1969, a vertical pharyngeal flap was performed by myself with incomplete im-
improvement in speech. The patient then moved to Kentucky and the palate flap was transected by the plastic surgeon at St. Joseph's Hospital in Lexington, Kentucky, in 1970. Speech regressed completely. Tonsils and adenoids were removed in October of 1974. On January 30, 1975, bilateral pharyngeal flaps were performed without crossing the mid-line scarring of the posterior pharyngeal wall.

B. Before B. After

B. S. A. S.—Seven-year-old male with a submucous cleft palate. The patient had undergone tonsillectomy and adenoidectomy, and nasality of speech was severe. On February 3, 1975, I performed bilateral transverse pharyngeal flaps.

C. Before C. After

C. D. W.—Sixteen-year-old female born with a cleft palate, post-alveolar. At two years of age the entire palate was repaired in Ann Arbor. Examination showed a splitting of the uvula and a residual cleft at the junction of the soft and hard palate. There was marked nasality of the speech. On February 7, 1975, the palate was repaired with transverse pharyngeal flaps.

IS IT WORTH IT?

It is difficult to estimate how important dynamic action of the muscular portion of a pharyngeal flap is. Preservation of nerve supply is always ideal and will probably maintain better mass. Whether what muscle contractions persist will have any real effect on the complex and delicate speech mechanism is yet to be determined.
BURIAN

FRANTIŠEK Burian, the tiniest giant in plastic surgery, was short in stature and in his later years, when I knew him, kyphotic. Yet his pioneering courage and fiery spirit made him stand tall among his peers. Because he was walled off from the rest of the world by the Iron Curtain, it was not until the middle 60's that the free world began to discover his depth of experience. Finally allowed to venture from behind the Iron Curtain, he was always accompanied by a communist colleague-watchdog. At the Stockholm Congress he confided on the sly to his free world cronies, including Ivy, two months his senior:

Now for a few days, I have emerged into the sunshine; tomorrow I return to the darkness.

At the Plastic Surgery Clinic in Prague, it was revealed that he had been using primary pharyngeal flaps since 1924. In his 1964 Gillies Memorial Lecture, he reviewed his 40 years of experience:
I postponed lip operations till the fifth month or even later, and palate operations till the fifth year. To prevent the collapse of the arch of maxilla, I interposed a flap of upper lip mucosa between the poles of the bone cleft. The palate operation consists of retroposition using the method of Kilner-Wardill, and fixation of the palate by means of pharyngeal flap with a superior pedicle.


Burian was indeed a pioneer of plastic surgery, and Fára has given me this little anecdote which perhaps with some paraphrasing paints his personality with color:

Whenever a fly was discovered in Professor Burian’s operating theatre, it invariably caused great shock, stimulating extensive effort to kill it. During one such exciting incident, a simple woman in charge of cleaning spied a fly sitting on Professor Burian’s shoulder while he was operating. With enthusiastic eagerness, she leapt up and swatted the fly with a great wet cloth! Everyone stirred uneasily. Burian looked slowly up at his assistant surgeon and asked calmly:
"Malice or stupidity?"
His assistant answered:
"Stupidity."
and the operation continued. Following the surgery, Burian consoled the weeping, apologizing cleaning woman:
"Do not worry, you showed us that you know about antisepsis. After all, the head nurse is responsible and never should have let the fly in in the first place."

In 1970 M. Fára, with E. Sedláčková, O. Klásková, J. Hrivnáková, A. Chmelová and I. Šupáček, reported that Burian, at the Prague clinic, had done his first primary pharyngofixation 46 years before and had been so impressed with the speech results and the reduced need for corrective operations that this procedure became routine. Of 2,689 primary palate operations, 2,073 were combined pharyngofixation. The technique involved a Kilner-Wardill type of V-Y retropositioning of the palate with the release in the nasal mucosa just posterior to the edge of the hard palate. Into the nasal defect the tip of a superiorly based, sometimes tubed, pharyngeal flap was sutured partially to line the nasal side and to fix the pushback with the pharyngeal flap.

Fára noted the two instances in which the pharyngofixation was not used:

(1) where the morphological and functional conditions are exceptionally favorable, and perfect velopharyngeal closure after simple retroposition can be expected; (2) in mentally defective children, where speech has no social importance.
Fára concluded:

The follow-up of our patients has shown that speech results, however great the retroposition, are much better in patients:
1. with (rather than without) pharyngofixation,
2. with primary (rather than secondary) pharyngofixation, and
3. with upper-based (rather than lower-based) flaps.

In 1972 Miroslav Fára with František Vele again presented the adjunct of tubing the superiorly based pharyngeal flap using its distal, opened portion, not unlike a blooming morning glory, for attachment to the anterior nasal side of the soft palate. They concluded that the quicker healing and reducing seen after tubing or closing the proximal aspect of the superiorly-based flap assists somewhat in preservation of the muscle fibers.

It was noted that, because the Czech language demands a high standard of palatopharyngeal closure, this flap contributes considerably to the good results of this cleft palate therapy.

MARINO

The intellectual, articulate and enthusiastic Hector Marino of Buenos Aires, Argentina, in 1942 was the first to write a comprehensive book on cleft lip and palate in the Spanish language. In 1949 he presented his idea of combining the pushback operation with the standard pharyngeal flap and published it in the *Bulletin of the Argentine Academy of Surgery*. In 1972 he wrote:

I recall how I came to perform the first case. In March, 1947, I had been lecturing in Brazil and decided to visit the beautiful old town of Ouro Preto which lies near Belo Horizonte. Upon arrival, I went to visit the professor of otolaryngology at the University and, upon handing him my card, found that he already knew me. It happened that he had a niece with a cleft palate who had been operated a number of times and without much success. He informed me that this niece was about to leave the next day for Buenos Aires to consult a Dr. Marino. You can imagine what followed: an immediate visit with the patient and a splendid stay in Belo Horizonte. Well, the poor girl was a sorry mess, one of those scarred palates with a long, long velopharyngeal gap. Anyway, she came to Buenos Aires and I combined the pushback operation with an inferiorly-based pharyngeal flap. The operation was a complete anatomic and functional success (perhaps beginner’s luck?!).
I had shelved the idea until one day in December, 1947, Drs. Gustav Aufricht and Jerome Webster, who had been to the IV Latin American Congress held in Montevideo, visited my office. I happened to see my Brazilian girl in the waiting room and showed her to my friends. Their reaction was most rewarding, as they admitted never having seen this combination done before. Coming from such a learned man as J. P. W., I realized the idea had some value and decided to publish it. But as nihil novum sub sole, I must say that, later on, I met in Spain a famous pediatric surgeon, Dr. Rovilarta of Barcelona, who I believe had the same idea more or less at the same time as myself.

Then one day, during the First Congress of Plastic Surgery (Stockholm, 1955), somebody spoke at length on this procedure and claimed priority for it. To everyone's surprise, Jerome Webster asked to come to the podium and, pointing to me, said that he believed there was the originator of the procedure and went on to tell about his visit to my office in Buenos Aires.

In 1950, in the British Journal of Plastic Surgery, Marino, with Renato Segre, advocated pharyngostaphyline fixation as a complement to the pushback operation. A Dorrance-type pushback with the nasal surface of the mucoperiosteum lined with a skin graft was held in backward position by the attachment of a thick, inferiorly based pharyngeal flap to the sutured posterior border of the velum. The union was filled with two layers of sutures. The authors noted:

The procedure guarantees against the loss of some of the backward displacement of very short palates, which happens quite often even with a correctly executed push-back operation.

They did not hesitate to dispense with this adjunct, if advisable:
We have observed in some cases that the results of re-education reached a not superable limit which was far from ideal. This was attributed to the rigidity imposed on the velum by the pharyngo-staphyline fixation. To go beyond this limit, it is felt that the union of the velum to the pharyngeal wall must be divided as soon as the anchoring effect on the push-back is no longer needed, and the reabsorption of scar tissue ends. This simple procedure is performed within two or three months of the attachment to the pharyngeal wall.

**SANVENERO-ROSSELLI**

In 1954 Sanvenero-Rosselli, at the First Hamburg Cleft Palate Symposium, proposed an extended use of his superiorly based flap to fill the nasal defect, following a releasing division of the nasal mucosa from the posterior edge of the hard palate in the primary operation, as presented by Honig in these sketches at the Second Hamburg Symposium:

![Sketches of surgical procedures](image)

According to C. A. Honig of Utrecht, the Netherlands, this technique of V-Y retropositioning, in combination with division of the nasal mucosa along the edge of the hard palate and the filling of this nasal defect with a superiorly based pharyngeal flap was not published.

In his 1963 thesis "On Pharyngoplasty" Honig summarized at the 1964 Hamburg Symposium:

We have investigated the functional and anatomical results obtained by this operation in 48 patients. All of these had previously undergone one or more operations for cleft-palate and all had unintelligible speech and defective closure mechanism, as observed through the open mouth prior to pharyngoplasty.
The competence of the reconstructed velopharyngeal closure mechanism was judged from contrast X-ray pharyngograms and from function tests. A sufficient closure mechanism was found in 42 of the 48 cases ... [and] the speech ... was assessed [as] good in 20, satisfactory in 12, poor in 13 and bad in 3.

This operation seems to be more extensive than the short releases and the narrower flap used by Burian, who also indeed used the pharyngeal flap for at least some nasal lining.

CONWAY

In 1951 Herbert Conway at Cornell Medical Center combined the pharyngeal flap with V-Y pushback operation. In 1955, at the Stockholm Congress, Conway, with Stark, elaborated on the importance of the inferiorly based flap in secondary cleft palate correction.

Conway had done some boxing in his youth and remained a dangerous infighter all his life. I enjoyed him and his con-artistry, once accusing him of being a crafty "old pro" with his ability "to hang on and hook" in close. He admitted to this attribute, and the drawings presented by him and Stark in the Stockholm 1957 Congress Transactions were examples of this art.
favored) and the attachment at the uvula of an inferiorly based pharyngeal flap, they presented the velopharyngeal distance reduced to 1 cm.

CHASE AND OTHERS

The same clever, two-in-one method of using the pharyngeal flap, both as a retracting suspension and as a mucosal cover to the raw nasal area, was developed independently by Robert A. Chase, professor of surgery, Stanford University, and reported in 1965 by Dibbell, Laub, Jobe and Chase. In 1976 I wrote the first author, David G. Dibbell, now at the University of Wisconsin, Madison, about this work and about his former chief. He answered:

I was a very junior member of the team at the time the paper was published. ... One thing that does come to mind about Chase: after he was made the Chairman of the Department of Surgery at Stanford University, when formally asked the nature of his profession, he would respond, not that he was a plastic surgeon or a surgeon, but that he was a medical educator. Obviously, his history from that time on has demonstrated that this objective has provided him with his main driving force.

In 1977 Bob Chase was requested to reminisce about this pharyngeal work. He wrote:

In surgery, as in life, a thorough familiarity with principles is the key. Imagination and curiosity coupled with a knowledge of principles has been the cause for turbulence between surgeons on the question—who should be credited with a new idea, operation, or technical wrinkle? It should be no surprise that individuals simultaneously or sequentially come up with the same ideas independently since most sensible ideas are based on fundamental principles.

For years there has been discussion about the problem of scar contraction of the raw palate surface as a cause for restriction of the palate and return to its forward position after pushback surgery. It seemed sensible to suggest that one strategy for resurfacing the raw area on the nasal surface, while at the same time taking advantage of the other possible virtues of the pharyngeal flap, was to use this pedicle flap to cover the nasal raw surface. We tried it and found it a useful technique.

On preparing material for publication in the customary detailed literature search, I came across a little-referred-to thesis by C. A. Honig presented in 1963. Honig rightly credited Sanvenero-Rosselli with having demonstrated
the use of the superiorly-based pharyngeal flap on the nasal side of the soft palate at a meeting in 1954. Honig's modification of the Sanvenero-Rosselli procedure is very similar to that described in our paper of 1965.

Far from being disappointed or embarrassed, I was delighted to see that the principle made sense to others and that their successes had borne out the good sense of application of those principles. It is not whose idea it is that is important but the fact of the idea itself that counts.

It comes down to fundamentals, and it does not take an intellectual giant to know that to be true. Take the good sense of Phil Esposito of hockey fame who, it is said, exhibited that sense in a recent T.V. interview. The interviewer, growing impatient with the general low key responsiveness of Esposito, said in desperation as the interview was drawing to a close,

"Come on, Phil, tell us what makes you such a great player?"
"Did your father motivate you as a child?"
"Was your uncle a great hockey player?"
"Do you do it for the overall team spirit and affection for your team mates?"

Esposito's answer, a classic putdown to this barrage of suggestions as to what makes him such a great hockey player, demonstrated his belief in fundamentals.

Said Esposito, "It helps a lot if you know how to skate."

In 1971, with Richard Yules, Chase re-endorsed this principle for secondary correction of palatopharyngeal incompetence and added:

This "secondary operative procedure" may provide an excellent primary procedure in select cases; if so, there is no contraindication to employing it before the child acquires poor speech habits.

Yules and Chase justified their approach with good reasoning:

An effective method is simply to attach the pharyngeal flap to the raw nasal surface, thereby preventing severe scar contracture both in the lengthened velum and in the free pharyngeal flap.

Chase prefers the more physiological superiorly based flap, concurring with the 1959 findings of Broadbent and Swinyard which demonstrated dynamism and electromyographic activity in these flaps. Thus Chase argued:

The philosophy on which we predicate our view is that the pharyngeal flap offers an opportunity to do more than anatomically occlude the velopharyngeal space; it may also provide help in elevating the soft palate for more effective closure.
Chase and Yules use a Dorrance or V-Y pushback, performing an osteotomy on the posterior wall of the posterior palatine foramen to facilitate retropositioning. With its base as cephalad as the atlas promontory, the pharyngeal flap is cut as wide as possible without impinging on the Eustachian tube orifices and long enough to reach the front of the cleft and line the raw nasal area. As they warned:

Care must be exercised to avoid injury to the ascending palatine arteries coursing on the posterior side of the pharyngeal wall approximately 1 cm. to either side of the median raphe.

They make no issue about primary closure of the pharyngeal donor area:

Some surgeons leave the defect unrepaired and allow it to heal by secondary intention, while others suture the margin of the defect together. Either method results in narrowing the palatopharyngeal isthmus, thus reducing the nasoapharyngeal port.

In 1973 in the *British Journal of Plastic Surgery* Richard Jobe of Stanford University reported adjuncts to facilitate combining a pharyngeal flap with a palate pushback. He advocated determining the length of the pharyngeal flap by measuring the distance from the posterior edge of the hard palate to the posterior pharyngeal wall. Then, after injection of 0.5% lignocaine with 1:200,000 adrenalin in planned operative sites, he advised elevating the pharyngeal flap in a dry field before doing the palate pushback. He also described another trick:

It has been our practice to place a loose suture through the tip of the pharyngeal flap. When the palate dissection is complete, a small Robinson
urethral catheter is passed orally into the nasopharynx through the nasal defect of the pushback. The suture in the flap is then threaded through the holes of the catheter and the catheter is withdrawn. Traction on the suture then brings the flap on to the nasal surface of the palate, where it is secured.

Jobe, anxious to set the record straight, wrote in 1976:

One day in the late 1960's, while I was doing a pharyngeal flap pushback operation of the type invented by Sanvenero-Rosselli and popularized by us at Stanford with Douglas Ousterhout, I was deriding a recent resident graduate of Stanford, who had had a one-page paper in *Plastic and Reconstructive Surgery* of a technique clearly stolen from one of our consultants without reference. During this conversation and operation, Ousterhout suggested to me the use of a catheter to pull a pharyngeal flap around the backside of the released palate to simplify considerably this procedure, when the palate is not divided.

Daisey Stilwell illustrated this neat trick and it was accepted by the *British Journal of Plastic Surgery*, but I forgot about Ousterhout's involvement. When the paper came out, Ousterhout was quick to razz me about stealing his idea precisely at the time I was accusing another. I have apologized to Doug but would be more than delighted if this tale and my apology could be exposed.

E. N. Kaplan of Stanford University, in a 1973 follow-up clinical report, noted that an additional 125 combined pushback and pharyngeal flap cases had been performed. He reported an improvement in all cases, the improvement closely related with the adequacy of velar mobility. No patient was made worse, and those least improved had unilateral or bilateral complete palate paralysis. Kaplan noted:
We believe that the palate pushback enhances the capabilities of a mobile palate by positioning the palate closer to the pharyngeal wall; also, the pushback frees the levator muscles from their abnormal insertions on the unyielding surface of the hard palate. The pharyngeal flap lines the raw nasal surface of the pushed back palate, thus preventing wound contracture that would pull the soft palate forward toward its preoperative position.

In 1977 R. Dijkstra of Zwolle gave his arguments in favor of a superiorly based flap to fill the nasal defect in a pushback. He cited the expendable pharyngeal wall donor area, ease of surgery and narrowing of the pharynx.

J. L. Grignon and G. Freyss of Paris in *Annales d’Oto-Laryngologie et de Chirurgie Cervico-Faciale*, 1969, presented their method of attaching a pharyngeal flap to the velum during a V-Y pushback.

Roland Minami of Greenbrae, California, threw a little sobering light on the lack of omnipotence of this or any palate procedure when he wrote in 1978:

My introduction to cleft palate surgery began during my first year of residency at Stanford, when an enthusiastic Chief Resident presented a girl
with severe hypernasal speech. She was 17 years old, mentally slow, had a
sister and mother with hypernasal speech, and was suspected of mimicking
them. "How are you, Miss Smith?" asked the Chief Resident. "Phhhhine!"
replied the girl. The next day she had a palate pushback and pharyngeal flap
which was then our standard operation for velopharyngeal incompetence.
Sometime later, we were showing off examples of our plastic surgical
prowess to the Chief of Surgery. Among them was the not-too-bright girl
who had had the pushback and flap. The Chief Resident proudly introduced
the patient and described her treatment. "How are you doing?" he asked
brightly. "Phhhhine!" snorted the girl, just as she had done preoperatively.
At the time, we found this episode amusing in a morbid sort of way.
However, I am sure that this scene has been repeated many times in plastic
surgery centers all over the world, and it is not funny. It does serve to
illustrate the insufficiently stressed fact that there are a multitude of factors
unrelated to the palate which influence the choice of operation (or not to
operate!) and the results that may be expected from such treatment. All
hypernasal patients are not alike, and should not be approached in a standard
fashion.

T TAILORING OF THE FLAP

The Burian-Fára-Rosselli-Honig-Chase two-in-one principle has
great appeal to the Scots strain in my ancestry. Yet this same
stingy streak nudged me to save the waste of a long, wide flap by
custom-fitting the design for the specific defect.

It so happened, one day in November of 1968, that three
plastic VIP’s, Jack Penn of Johannesburg, Jan Strombeck of
Stockholm and Ross Musgrave of Pittsburgh, were crisscrossing
at Miami International Airport, and the delay in flights allowed
them a little time in our operating room at Jackson Memorial
Hospital. A wide, unoperated adult cleft palate was scheduled,
and the mouth was large enough for the “Big Three” to see an
island flap being inset. As I lifted the mucoperiosteal flap on the
first side, a meager, string-like anomalous structure represented
the neurovascular bundle. This was dismissed as a possible carrier
for the island.

An advantage of this method [I sighed, with beads of perspiration appearing]
is that, should anything happen to one side, there is always the second side
to supply the island.
The second side was like the first, and by this time I was sweating profusely, having already divided the soft from the hard palate. During an embarrassing silence, we all stared through the large elliptical hole in the nasal lining.

In desperation, it occurred to me that a pharyngeal flap based superiorly and of Chase's length could be shaped as a T and used to line accurately the entire nasal pushback defect as well as the anterior two-thirds of the soft palate cleft. The procedure went well, and Penn, at the end, allowed that "necessity is the mother of invention."

In spite of the width of the cleft, there was marked improvement in speech which could have been even more pronounced had the patient, who is a police radio operator, been willing to take time off from tracking crooks for speech therapy.

The method was published in *Plastic and Reconstructive Surgery* in 1970 with the accompanying diagrams.

Another T pharyngeal flap was used in a secondary lengthening of an operated complete cleft in a 13-year-old girl with nasal speech; she had a very short, scarred palate riddled with fistulae, rendering an island flap impractical. Five months after surgery, her speech had improved to such a degree that she won a school prize in speech and was given the lead in her class play. She can blow up a balloon for the first time, and her grimaces have almost completely disappeared.

This T pharyngeal flap has been used four times. The need is rare, but surgeons embracing this principle might find it of value. It allows a tailored closure of the nasal pushback defect at the same time it provides a suspensory synechia to maintain length. It takes tissue from outside the palate, and the eventual reduction in the pharyngeal vault is an extra advantage in speech. The base of the flap can be used in the nasal closure of the actual soft palate when this cleft is wide and requires extra tissue. The blood supply of the posterior pharyngeal wall, supplied by the ascending and descending pharyngeal vessels, is adequate to nourish the T. The prongs of the T need not be exactly transverse but can be directed obliquely to enhance the potential blood supply. Or, as Chase suggested when the T was offered to him: "Can we split the end of the flap?" The base should be of generous width and,
with the base placed superiorly, the T must be taken from well down on the pharyngeal wall to provide adequate flap length to reach the anterior defect at the posterior edge of the hard palate. This procedure calls for a bit more surgery than an island flap or even a routine pharyngeal flap, but when indicated, it can help to solve a difficult problem. It is available as a primary or a secondary procedure.

FOR EXTRAORAL MUCOSA

Australian Anthony J. Emmett, after training in plastic surgery with two Hawke Bay New Zealanders working in England, eventually returned to Brisbane. Here he is involved in various transplantations and modifications. On his farm he successfully transplanted 60 olive trees out of 400, and he is raising Braford cattle, a crossbreed of Brahma and Hereford, originally developed to flourish in Florida heat by my friends, the Alto Adams of Fort Pierce. In palate surgery he has modified the standard pharyngeal flap by taking a full-thickness flap of mucosa and muscle with a high, superior base and cutting it 2 to 3 cm. wide and 6 to 8 cm. long. The distal 1 to 2 cm. retains its mucosa while the next 5 to 6 mm. of the pedicle is carefully denuded, presenting a mucosal island with a raw neck which is passed through a transverse split in the palate and used for additional mucosa on the oral side. As he wrote in 1977:

This operation is indicated for the palate which is short and scarred where it is desired to put a flap of elastic pharyngeal mucosa into the oral surface of the palate at the junction of the hard and soft palate. . . . The flap can be brought through the palate by simply having divided the palate transversely to allow the soft palate to fall back. Generally we prefer to split the palate as well as divide it transversely.

COMPARISON OF PHARYNGEAL FLAP INSERTIONS WITH OR WITHOUT PUSHBACK

In 1977 at the Third International Cleft Palate Congress in Toronto, Michael Lewin, with Daniller, Croft and Shprintzen of
Montefiore Hospital, the Bronx, reported comparison of three different insertions of wide, superiorly based pharyngeal flaps in 100 patients observed over six months postoperatively with multiview videofluoroscopy and nasopharyngoscopy.

1. The U-shaped pushback (Dorrance) includes transverse division of the palatal aponeurosis and nasal mucosa with insertion of the distal one-fourth of a wide pharyngeal flap to line the nasal side (Sanvenero-Rosselli, Honig, Chase). The rest of the unlined pedicle suspended in the nasopharynx contracts into a tube.

2. The sandwich attachment splits the posterior edge of the soft palate horizontally above the uvula and extends laterally along the posterior pillars. Into this pocket is fitted a short, wide pharyngeal flap including its mucosa (Webster). Because of the width of attachment, the flap does not curl but contracts in an anteroposterior direction.

3. The soft palate is split three-fourths of its length. The nasal mucosa and the aponeurosis are divided from the hard palate, and the levator muscle is repositioned and sutured (Braithwaite). The pharyngeal flap is introduced into the longitudinal split on the nasal side with the uvula being sutured to the base of the pharyngeal flap to provide lining.

They summarized:

The closure of lateral gutters on phonation, which is essential for elimination of hypernasality depends primarily on the amplitude of LPW [lateral pharyngeal wall] movement. The latter is an important factor in predicting the success of the operation.

The unlined pharyngeal flap, combined with pushback [1], provides the least obturation. The sandwich flap [2] is highly effective but tends to over-obturate the nasopharynx and results in a high incidence of hyponasality. The pharyngeal flap, combined with splitting of the palate and recession of the velar musculature [3], is suited for a majority of patients with VPI. Its failures seem to be limited to patients with absence of LPW movement.

Donor area

The pharyngeal flaps in this comparative study took the entire
width of the posterior pharyngeal wall, and the donor area was closed except for "a small dime-shaped raw area" at the flap base. Primary closure was considered to reduce morbidity and minimize descent of the flap base by contracture. Lewin and his colleagues admitted, however:

Examining patients a few months after operation, we found no visible difference between those where the wound healed by contracture and those closed by suturing.
Immediate postoperative complications are more common after posterior pharyngeal flap surgery than with the usual palatal cleft closure. Pharyngeal flaps can, of course, be used to relieve tension in the closure and so to reduce certain complications. Yet the invasion of the normal posterior pharyngeal wall and its musculature and the abnormal attachment of a flap, partially raw on its undersurface and spanning an open space to a needy but unsuspecting velum, are not without a price.

There have been fatalities. In 1886 Schoenborn reported 20 pharyngeal flaps with one death due to pneumonia. In 1929 W. Kindler reported four cases of pharyngeal flaps with one death due to mediastinitis. Rosenthal, Axhausen and others warned that pharyngoplasty should not be performed in the first 10 years of life. Numerous accounts of intraoperative and postoperative complications from pharyngoplasties in infants exist. Schröder in 1959, Skoog in 1965, Owsley in 1965, and others told of the necessity of tracheostomies. However, in 1968 W. Bethmann and H. J. Hochstein of the Rosenthal Clinic of Thallwitz, Leipzig, reported on 529 pharyngoplasties in an eight-year period in children of the average age of 7 years without a tracheostomy or death. They noted:

During work in the pharyngeal region, considerable changes of the heart rhythm sometimes occurred (sinus tachycardia, bradycardia, bigemina). . . . Sufficient premedication and depth of narcosis are of decisive importance.
Mortality is very low today because of improved anesthesia and postoperative recovery room care, but deaths can happen. Sudden hemorrhage and airway obstruction are the most likely causes. In 1970 Yules confirmed this when he stated that, excluding potential anesthesia risk, complications were most often related to severe bleeding—with or without associated airway obstruction—with mortality usually associated with pharyngeal flap surgery.

Hemorrhage is more common after use of pharyngeal flaps, and bleeding in this area is not only awkward to get at but dangerous to the airway. Prior to surgery, the nasopharyngeal aperture has been generous, and the sudden partial to near-complete obstruction of this air passage can cause anxiety, panic, straining and gasping, which in turn may start bleeding. The prime reason for suturing the flap's donor area, in my opinion, is its early hemostatic effect. In 1966 Bengt Nylen and Åke Wahlin of Stockholm reported on airway complications of 103 pharyngeal flaps. They summarized:

There were 14 instances of postoperative complications (14% of the total group) and all were in connection with bleeding, which has also been important in other series. In 11 of the 14 cases the bleeding was checked by conservative measures or blood transfusions and did not cause concern, while in four tracheostomy had to be performed (with one death). We believe that the hemodynamic stress at extubation and laryngeal suction is due to reflex activation of sympathetic vasoconstrictor activity and venous blood congestion in the head and neck, in connection with coughing and straining and are the main causes of postoperative bleeding from a dry operative field. Extubation should therefore be planned with great care.

Yules and Chase, in the 1971 book *Cleft Lip and Palate*, list 18 groups using pharyngeal flaps with a complication ratio of about 10 percent. The compiled data of Nylen and Wahlin; Owsley, Lawson and Miller; Skoog; Edgerton; Smith, Huffman, Lierle and Moll; Walden and Rubin; Dunn; Moran; Williams and Woolhouse; Conway; Conway and Goulian; Stark and DeHaan; Gray and Jones; Champion; Longacre and DeStephano; Cox and Silverstein; Buchholz, Chase, Jobe and Smith; and Bernstein reveal a total of 1,149 pharyngeal flaps. In conjunction with them, there were recorded 3 hematomas, 19 respiratory difficulties, 15 tracheostomies, 37 flap detachments, 7 ear infections, 10 denasalities, 36 severe hemorrhages, 10 transfusions required.
With these findings in mind, Yules and Chase warned that for the first two days after surgery the patient must be watched very carefully for hemorrhage and respiratory obstruction. They noted that obstruction of the Eustachian tubes with mild otitis media was not uncommon and breakdown of the flap attachment was usually associated with bacterial infection. Even a fatality is a possibility which in the past exceeded 1 percent but has been reduced to about 0.3 percent. Single fatal cases of meningitis and mediastinitis have been reported.

In 1978, at the American Cleft Palate Association meeting, Bernard Borowiecki, Charles Pollak and Charles Croft of Montefiore Hospital, New York, commented:

A common finding in post-pharyngeal flap patients (children) is obstructive respiratory difficulty during sleep. . . . Some patients may continue to experience obstructive respiratory difficulty during sleep leading to development of obstructive apnea-hypersomnia syndrome and even death.

In 1973 Graham, Hamilton, Randall, Winchester and Stool noted that airway complications following the construction of posterior pharyngeal flaps were most frequent in children with micrognathia or other severe congenital anomalies. In the Pierre Robin syndrome, caution should be exercised before deciding to combine a pharyngeal flap and a palatal closure in one operation. An armored nasal tube may be useful postoperatively to ensure an adequate airway. These authors also advised that if tonsils are excessively large, particularly in small children, tonsillectomy be done at the time of the pharyngeal flap operation.

A painful "sore throat" and stiff neck are common complaints of the patients and have made this operation unpopular with me. Closure of the generous donor area under tension with large retention sutures or otherwise is seldom permanently successful and is responsible for the pain. Fára insists that muscle sutures will achieve permanent closure, but I have not had 100 percent success. When the wound separates, it leaves a wide, messy granulating area which will eventually heal by contracture and epithelialization.

A certain number of flaps become detached. In this event immediate reattachment or delayed re-flapping is called for. Reports of detachment of the flap are scattered through the
literature, but many more cases, of course, are unreported. In 1960 Ross Musgrave and John Bremner of the University of Pittsburgh reviewed 780 cleft palate operations performed over a 10-year period, 1950–1959. They stated:

It is noteworthy that most of the 22 pharyngeal flaps that have been performed were secondary procedures for palates shortened by scar contracture of failed primary healing. Only one of the pharyngeal flap operations had any complications, this being detachment of the flap.

Pigott of Bristol tells of his pharyngeal mishap:

Once while teaching the houseman how to raise a pharyngeal flap and in getting the base really high using double-curved scissors out of sight above the soft palate, I amputated the flap completely! The patient, an intelligent young man, was a total success as the isthmus contracted down to a very small port which could open and close with perfection. Astley Cooper used to do this routinely, but I never dared do it again.

Finally, there are the insidious complications in the healing of the flap which render it ineffective. These include immobilization of the soft palate by incorrect positioning of the flap’s base for optimal velar action and simple flap contracture, dragging the velum down, frequently asymmetrically, to close only one port. There is also the rolling of a flap into a string tube with loss of its important obturator effect.

Pharyngeal flap reduction of velar mobility, for better or worse, is a fact. Joanne Subtelny, N. Oya, D. Subtelny, J. Curtin and R. McCormack in 1970 made a preoperative and postoperative analysis of velar and pharyngeal flap mobility. They asserted:

Despite the effectiveness of pharyngeal flap surgery, the results of this study indicate the technique generally does reduce velar mobility as reported by Skoog. Mobility of this flap is, however, significantly related to the extent of velar movement observed before surgery.

They also noted a reduction in the anterio-posterior aspect of the pharynx. As shorter pharyngeal dimensions have been identified with less nasality, the relative importance of the pharyngeal environment and its influence upon postoperative speech status is emphasized.
Karl S. Musgrave, in his 1971 master of science thesis at Eastman Dental Center and Graduate School of the University of Rochester, New York, reported his extensive cephalometric radiographic evaluation of pharyngeal flap surgery. Sixty postoperative pharyngeal flap cases were separated into successful and unsuccessful groups by nasality ratings. The comparative preoperative cephalometric data, which turned out to be 89 percent predictive of postoperative results, revealed that the non-nasal speakers had (1) greater elevational velar mobility resulting in a smaller palatopharyngeal opening, (2) a shorter nasopharyngeal depth and (3) a smaller nasopharyngeal area. These preoperative features, in addition to a younger age at the time of operation, suggested an important requisite in pharyngeal flap surgery's attaining a high-positioned pharyngeal flap base attachment with good elevational mobility, thus enhancing the pharyngeal flap mechanism for production of adequate velopharyngeal closure during speech.

In 1969 Richard Yules and Robert Chase reviewed the literature on pharyngeal flaps and concluded:

Although pharyngeal flap surgery has justified its popularity, the failure rates even as noted indicate refinements yet to be made in flap surgery... Before the pharyngeal flap procedure can stand up on its own as a procedure of choice within a given cline of cine, speech, and respiratory study measurements, pre- and postoperative reliable measurements must be available. The present literature is remarkable for the relative absence of any such measures.

**PHARYNGEAL FLAP SECONDARY SURGERY**

It is important to keep in mind that, despite what might be expected from the vast number of pharyngeal flaps being used today, this flap is not omnipotent or a cure-all. Skoog wrote:

A pharyngeal flap will not fully substitute for soft palate tissue in cases in which there is poor muscular function or a substantial deficiency of tissue... It can be used to reconstruct a palatal membrane which will reduce nasal escape... but will not reproduce normal speech.
Barrett Brown of St. Louis was not an enthusiastic admirer of the posterior pharyngeal flap, but since he and his group were treating as many clefts as anyone else at that time, perhaps more, he did have occasion to use it sometimes. Frank McDowell informed me:

On rare occasions, Brown (and the rest of us) did a pharyngeal flap (secondarily) . . . usually by the method described by Padgett. Probably we did not do wide enough ones, or did something else wrong. Too often they seemed to coil up into a string or rope, which then acted as a tether to restrict movements of the velum.

Josh Jurkiewicz, one of Brown’s residents, recalled:

Furthermore, he had little use for pharyngeal flap procedures and probably severed as many as any man alive. He saw a lot of failures after pharyngeal flap procedures, which at that time were simple attenuated tubed flaps, and he merely took these down, all the while castigating the procedure and occasionally Earl Padgett.

Pharyngeal flaps often are called upon to correct the residual velopharyngeal incompetence following other surgical procedures. Although these flaps, with their obturation, tethering and pharyngeal narrowing, do assist and are usually responsible for improvement in speech, there are many pharyngeal flaps which fail to solve the incompetence. The gap may be too wide, the scarring of the velum too extensive, the pharyngeal flap too narrow or its base not set at the optimal position.

In 1972 and 1973 Leon Skolnick and Gerald McCall, using videofluoroscopy in multiple projections (lateral, frontal and basal), studied velopharyngeal competence and incompetence following pharyngeal flap surgery. They found

the incompetent velopharyngeal mechanisms to be attributable to abnormalities of (1) flap width relative to the extent of medial movement of the pharyngeal walls, (2) flap position in relation to the pharyngeal walls on the horizontal plane and (3) flap level vertically in the nasopharynx as related to the region of maximum medial pharyngeal wall movement. These abnormalities have been noted to result in incompetence of one or both portals lateral to the pharyngeal flap.

Such findings, especially in the presence of continued velopharyngeal incompetence and poor speech, require secondary pharyngeal flap surgery.
John Q. Owsley, Jr., of the University of California, San Francisco, being born into a Navy family, naturally took to the sport of ocean racing, leaning his 6 foot 5 inch frame against all weather and winds. He also became the troubleshooter for failing pharyngeal flaps, investigating the causes of failure and prescribing the possible cure. In 1965, with Blackfield, he had emphasized the importance of maintaining an upward posterior vector of motion of the soft palate when attaching a pharyngeal flap. He noted the low pharyngeal flap which, when attached at the posterior margin of the soft palate, produces traction in an inferior or straight posterior direction and may actually restrict normal palatal elevation.

In 1972, with Brevator Creech and Herbert Dedo, Owsley said:

A significant number of patients with residual velopharyngeal incompetence after a pharyngeal flap operation have been found in our experience to have just this type of restrictive flap. Clinical and cinefluorographic examination of these patients suggest that the central pharyngeal flap acts as a static obturator. If there is good palate mobility and pharyngeal muscle movement, many low attached pharyngeal flaps will provide non-nasal speech. However, if palate elevation is restricted and pharyngeal muscle activity is ineffective or easily fatigued, then hypernasal speech persists.

In the 1972 Cleft Palate Journal they presented drawings demonstrating restrained action in the presence of a restrictive pharyngeal flap: (A) at rest and (B) phonating "ah." Their recommendation was logical:
It therefore seems reasonable to suggest that poor speech due to a restrictive pharyngeal flap may be improved by division of the flap and reattachment of a new, high, anteriorly attached flap.

They divide the previous flap from the pharynx and suture the small defect in the pharynx. The soft palate is split, facilitating a view of the posterior pharyngeal wall, which appears unscarred in spite of its being the previous donor site. A new flap is cut with its superior base above the tubercle of the atlas. The recipient site is developed on the anterior nasal aspect of the soft palate by reflecting posteriorly based flaps of palate mucosa. After the pharyngeal flap is sutured into the recipient site, the mucosal flaps are used to line the raw undersurface of the pharyngeal flap and reduce inferior migration of the base of the flap again. No attempt is made to close the posterior pharyngeal donor area. The postoperative result in five patients was encouraging.

By 1976 Owsley, with Lucie Lawson and George Chierici, had had increased experience with the "re-do" pharyngeal flap:

Twelve patients with persistent hypernasal speech after a previous pharyngeal flap operation had a second pharyngeal flap operation performed by the high-attachment technique. Six of them achieved complete or near complete correction of hypernasality in connected speech. Four showed speech improvement of a lesser degree. Two patients had no significant improvement.

WEBER

In 1970 in the British Journal of Plastic Surgery Jaroy Weber, Jr., R. Jobe and R. Chase of Stanford University reported five patients with hypernasal speech resulting from low-lying, restrictive pharyngeal flaps. It is fortunate that Weber, with a trained ear and involved in American folk music playing the guitar, mandolin and banjo, should gravitate to palate surgery. These authors noted:

Superiorly based flaps... placed high in the posterior pharyngeal wall have augmented velopharyngeal function and have not appeared significantly to restrict palatal motion, either inferiorly or superiorly (Buchholz et al., 1967). Cinenes of our patients after pharyngeal flaps have been indistinguishable from those of patients who have had pharyngeal flaps performed at the University...
of California by the method described by Blackfield (Blackfield et al., 1963). . . . Flaps placed low on the posterior pharyngeal wall, . . . have been felt to tether the palate in an inferior direction.

They acknowledge that migration in the postoperative period, a result of scar contracture between the flap and its bed on the pharyngeal wall, can affect the location and pull of the flap. In defense of the Stanford method, they stated:

The importance of the site of the attachment of the pharyngeal flap to the palate has not been sufficiently emphasised. It is felt that the flap should be sutured at, or anterior to, the central insertion of the levators. This provides a surface for the raw nasal side of the palate over the levator insertion and thereby inhibits scar formation between the levators and the hard palate. . . . The increased superior motion of the palate due to the levators may also inhibit inferior migration of the flap origin on the post-pharyngeal wall.

Two of the five patients with restrictive pharyngeal flaps were improved by division of the flap and construction of a superiority based flap in conjunction with the palate pushback.

**DIRECTION OF CONTRACTURE**

It is true that any raw area on the undersurface of a superiorly based flap will tend to pull the velum upward while its donor area is pulling downward. The opposite is true of an inferiorly based flap as the flap's raw area pulls downward while the donor area pulls upward. These counteracting actions probably explain why postoperatively it is often difficult to determine whether the flap was based above or below.

Tord Skoog of Uppsala learned respect for the downward drag of the donor area of a superiorly based flap and designed a three-fingered pharyngeal flap. He folded the two lateral narrow flaps under the main flap to line the junction of the flap with the raw area on the pharynx in a gesture to interrupt the potential contracture web. It is possible that a longer transposed flap from one side alone could well block contracture. At least, this principle is a prophylactic step against a possible complication.
AUGMENTATION BY FLAPS

Bard Cosman and Arlene Falk of Columbia-Presbyterian Medical Center stated in 1975:

Nasality persists in a small but significant number of patients who have had a pharyngeal flap. In addition, nasality may recur long after doing an initially successful procedure.

The causes of such primary and secondary failures are probably faults in the relative size and/or positions of these nasopharyngeal obturators.

They noted three methods of repositioning the pharyngeal flap:

1. Weber's repositioning divides the tethering inferior base and attaches a new, superiorly based pharyngeal flap at a much higher level on the nasal surface of the velum. The new flap is raw on its undersurface.

2. In McEvitt's repositioning, the inferiorly based flap is converted to a superiorly based one.

3. Owsley's repositioning divides the old, inferiorly placed base and attaches a new superiorly based flap high on the palate using a hinged-back lining from the nasal surface of the palate.
Cosman described his augmentation of a failing posterior pharyngeal flap. First he turns two inferiorly based pharyngeal flaps back from the lateral posterior wall on either side of the present pharyngeal flap. Then he turns two matching mucosal flaps from the lateral oral side of the velum with their bases on the posterior edge of the palate. These four flaps are overlapped on each side to augment the inadequate center attachment and to reduce the lateral apertures.

In the 1976 *Cleft Palate Journal* Bernard Hirshowitz and Dahlia Bar-David of Haifa, Israel, endorsed Cosman's principle of pharyngeal flap augmentation. They reported success in three cleft palates that had experienced failure with pharyngeal flaps. A secondary pharyngeal flap of maximal width and adequate length was based superiorly at the level of the previous flap. It was divided down the seam scar of the previous donor area, and each end of the double flap was tucked into a pocket split along each side of the posterior edge of the soft palate.
In 1977, again in the *Cleft Palate Journal*, the same Israeli team suggested another approach. They repositioned the base of superiorly based pharyngeal flaps, which had migrated inferiorly and which were associated with persistent hypernasality, with a V-Y upward advancement of the base. Relief of the downward tethering effect in four cases was followed by gratifying correction of hypernasality.

**ADDITIONAL TEFON**

In 1972 H. S. Sturim and C. T. Jacob, Jr., of Brown University, advocated the supplemental injection of Teflon behind the posterior pharyngeal wall in patients in whom a pharyngeal flap had been unsuccessful.

**PHARYNGEAL FLAP'S SECONDARY EFFECT ON THE MAXILLA**

It is conceivable that the tethering of a pharyngeal flap attached to the velum could have some retracting effect on maxillary development. Certainly, a broad, unlined pharyngeal flap, used in an early primary cleft closure, with the subsequent contraction, has the best chance of transmitting backward pull on the growing maxilla. There is, however, little consistent confirmation of this influence in the literature to date.

In 1976 Robert Pearl and Ernest Kaplan of Stanford University Medical Center reviewed clinical and cephalometric records of 25 patients who had had a superiorly based pharyngeal flap
with a palate pushback. Linear and angular cephalometric measurements of these children revealed no later growth retardation of the face. There was an inherent tendency of the secondary palate cleft, classic submucous clefts and occult submucous clefts to demonstrate preoperatively a narrow SNA and SNB—but the difference between these two angles (ANB) was normal.

In 1977 R. Bruce Ross of the Hospital for Sick Children, Toronto, reported on 62 patients who had pharyngeal flaps attached to the soft palate. Serial cephalometric radiographs, from the time of operation for an average of 6.7 years (minimum, 3 years) from a mean age of 8.2 to a mean age of 14.9 years, were matched with twice the number of controls of the same sex, cleft type and age. He noted:

Several of the many growth measurements showed significant differences between sample and control groups. The conclusion, however, was inescapable that pharyngeal flap surgery performed at these ages does not interfere with maxillary growth.

In 1977 Roberta Pineda and J. Daniel Subtelny of Rochester, New York, studied the effects of primary pharyngeal flap surgery performed on 24 cleft palate individuals prior to the prepubertal growth period. Two control groups were used for comparison—28 non-cleft individuals and 18 cleft palates without a pharyngeal flap. Comparable longitudinal cephalometric records indicated that pharyngeal flap surgery has an effect on maxillary growth. When compared with the normal sample, both cleft samples, with and without pharyngeal flaps showed some reduction in forward maxillary growth. However, the pharyngeal flap group showed significantly greater reduction in maxillary forward growth.

Gaston Maillard of Lausanne, Switzerland, trained by Tessier, Dufourmentel and a Maytag Fellow in Miami, has observed again and again the impossibility of moving the maxilla forward after osteotomy against the firm fixation of a pharyngeal flap. Only after division or lengthening of the flap can the maxilla be advanced, and, on this basis, he feels certain that early pharyngeal flaps have a retracting effect on maxillary growth.
Maxillary Advancement and the Pharyngeal Flap

Paul Tessier of Paris, as an invited professor at the University of Pennsylvania, carried out two maxillary advancements in which posterior pharyngeal flap attachments had to be lengthened to allow the maxilla to come forward. Randall, at the time of surgery, suggested a method of lengthening the pharyngeal flap without dividing it but did not check with Tessier (there is some language barrier) to see whether he had used this procedure before. The method designed was utilized and then soon reported without mentioning the fact that Tessier was the surgeon. The publication, by resident Robert Ruberg, Peter Randall and Linton Whitaker, appeared in the March 1976 issue of Plastic and Reconstructive Surgery, presenting a logical lengthening of a previously existing posterior pharyngeal flap in order to preserve its attachment when maxillary advancement is necessary. Lateral relaxing incisions were made on either side of the base of the previous flap. The inferior portion of this strip was divided and the flap dissected upward, maintaining a superior base. The inferior portion was employed to line the underbelly of the upper portion as the flap was lengthened to allow maxillary advancement.

This publication infuriated Tessier, who had used the procedure before. In the September 1976 issue of Plastic and Reconstructive Surgery, Whitaker wrote an apology:

We neglected to mention that Dr. Paul Tessier was the operating surgeon on the two cases described in the article—though the idea of lengthening the flap was, insofar as we know, first conceived by Dr. Randall. We have done this procedure since on other patients.

Tessier was not appeased.

Maxillary Advancement May Require Pharyngeal Flap

At the Craniofacial Symposium at the University of California, Los Angeles, in 1977, S. A. Wolfe inquired of those who are advancing maxillae how many advancements were causing velopharyngeal incompetence. He reported:

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Dr. Paul Tessier stated that in his series of about 150 LeFort III advancements, he recalled 5 or 6 who developed VPI which persisted and required pharyngeal flaps—and they were all Apets, who generally have a submucous cleft.

Henry Kawamoto of UCLA said that in his own relatively small series of about 20 LeFort I advancements, 4 developed VPI requiring PPF.

These were all CL/CP patients who were borderline pre-op—and the surgery nudged them over into gross VPI.

Reed Dingman of the University of Michigan noted in a case appearing in this volume that LeFort III maxillary osteotomy produced velopharyngeal incompetence in a cleft lip and palate case with borderline speech. He used a pharyngeal flap to correct the problem.

Ian Jackson of Glasgow noted in 1977:

We are often presented with a young child with nasal escape who will require a later maxillary osteotomy. In a small portion of cases this osteotomy will cause a recurrence of his velopharyngeal incompetence. In these, if the escape is mild or moderate and the child can cope, the situation is left untreated until after the osteotomy. If escape is severe . . . then a pharyngoplasty is performed.

In 1977 Mary Anne Witzel and Ian R. Munro of the University of Toronto described a 16-year-old postoperative cleft lip and palate patient who, after his maxilla was advanced 10 mm. and rotated down 4 mm., revealed hypernasality. Six months later, a palatopharyngoplasty restored his speech. Later that same year, Witzel and Munro reported further study of the effect of maxillary advancement after osteotomy on articulation and velopharyngeal function in 61 osteotomies (LeFort I, LeFort III and others). When articulation was directly tied to malocclusion, they noted, there was improvement in articulation after osteotomy with correction of occlusion. Of 18 cleft lip and palate cases, hypernasality occurred in five following LeFort I. It was found that patients who revealed a borderline mechanism preoperatively generally developed hypernasality. Those who were borderline preoperatively and remained so after maxillary advancement had a Passavant’s ridge which evidently adapted by increasing its excursion.