III. Lengthening the Palate
23. Lengthening of the Cleft Edges of the Uvula and Soft Palate

ONCE the sophistication of cleft palate surgery had advanced beyond merely closing the cleft hole, attention turned toward closure of the velopharyngeal aperture. Ingenious efforts were directed to surgical procedures which in various ways caused lengthening of some portion of the palate toward the posterior pharynx. These procedures of V-Y, transverse incisions closed vertically, angled releases and Z-plasties seemed to parallel in part some of the techniques used by lip surgeons to lengthen the short edges of the cleft labial elements. The first such effort is accredited to André Myrhrhen in 1706. It is reported that he lengthened a soft palate by a method not described to compensate for a completely destroyed uvula and caused no damage to the patient’s speech.

LENGTHENING THE UVULA

In 1879 William S. Forbes of Philadelphia, while closing a cleft of the uvula, lengthened the velum by a curved incision which was a combination of V-Y and transverse incision closed vertically, similar to that used by Nélaton in incomplete lip clefts. This procedure undoubtedly created the longest uvulæ in existence, whatever good that did!
KUSTER

The German E. Kuester attempted in 1882 to lengthen the velum with slanted lateral incisions in a V-Y type of principle similar to that used by Malgaigne in cleft lip. The result was a long, fascinating, trilobate uvula without improvement in function. Reverdin carried out a similar procedure in 1898.

BLAIR

In 1911 Vilray Blair of St. Louis used angled releasing incisions to form triangular flaps of the velum, not unlike his later cleft lip flap, to achieve palate length. By advancing palatal mucoperiosteum and cheek mucosa medially, he was able to get lengthening of the palate without too great side-to-side tightness. As he said:

The cleft borders of the velum are [incised] . . . on either side through the whole thickness of the soft palate and the flaps behind these incisions are rotated backward. In this way, the incisions . . . are opened and the raw surfaces thus exposed are sutured to each other at the median line. . . . This operation gives a longer velum than is obtained by the simple Langenbeck operation and therefore a better functional result is obtained. It will not permanently cripple the action of the superior constrictor muscle of the pharynx.

MASON

The most radical of the uvula-lengthening procedures was described in 1877 by Francis Mason of St. Thomas’s Hospital and Kings College Hospital, London. As he still agreed with Passavant and Gustav Simon that nasal twang in speech was due to
shortening of the palate, he was stimulated to describe and discuss an operation he had designed in 1869. With a sharp, pointed knife he divided the palate completely from the hamular process (A to B) bilaterally, noting that the parts united in a V-shaped angle. He explained his rationale:

The palate becomes converted into a huge uvula, so to speak . . . so that if it does not actually touch the back of the pharynx it approaches it so nearly as to divert the current of air to a considerable extent from the nose into the mouth, and thus greatly obviate the disagreeable guttural voice.

Z-PLASTY LENGTHENING OF THE SOFT PALATE

In 1950 T. P. Kilner of Oxford suggested obtaining the greatest possible length in the velum by making small incisions at right angles to the pared margins of the cleft or undertaking a Z-plasty of the nasal mucous membrane and, if need be, the palatal mucous membrane.

Randell Champion of Wythenshawe Hospital, Manchester, England wrote in the British Journal of Plastic Surgery in 1957:

The nasal membrane may be lengthened by undertaking a Z-plasty of the nasal mucous membrane. This small plastic manoeuvre is of utmost importance in the primary repair of a cleft palate and may make the difference between normal and imperfect speech. The Z-plasty also tends to reduce the palato-pharyngeal opening. In a small percentage of primary repairs it is not possible to perform the Z-plasty, particularly in clefts involving most of the hard palate . . . . In secondary repair of palate the creation of a large Z-plasty or two smaller Z-plasties may materially influence the final result.

As Lyndon Peer with Walker and Meijer of New Jersey wrote of the bone flap method in 1964 in Plastic and Reconstructive Surgery:

The procedure, however, does not provide for additional lengthening, and if one starts with a short palate, one ends up with a palate of the same length. If the shortening is marked, we lengthen the soft palate with a Z-plasty . . . .
The incisions for this Z-plasty include muscle and both mucous membrane surfaces.

SCHUCHARDT

At his Second Hamburg Cleft Palate Symposium in 1964, Karl Schuchardt spoke for improving “old methods.” He philosophized before he promoted his own modification:

Besides this I think results do not only depend on methods but also on the way we use them. And I must say that with the old Langenbeck-Ernst-Veau procedure, which is described in the book of Axhausen and which I improved by the lengthening of the velum with a Z-plasty of the mucous membranes of the oral as well as the nasal side, we got such good anatomical shapes and functional results that I see no reason to change our procedure at all.
He spoke from an experience of nearly 1,000 cases.

In 1961 Edgerton facilitated palatal lengthening with sharp dissection of the neurovascular bundles. This resulted in a shortness in the nasal mucosal lining. He advocated the Z-plasty principle as his preference for lengthening this nasal mucosa.

**A PALATE Z ROBS POOR PETER IN PRINCIPLE**

My concern about Z-plasties of the soft palate or nasal lining is basic. The mere presence of a cleft of the palate indicates missing tissue, which may vary in amount, and closure of the cleft necessitates pulling the sides toward the midline with relative tightening in the transverse dimension. This result will be more exaggerated with short, diminutive palates with wide clefts. Too much side-to-side tightness will, of course, counteract the effectiveness of the pushback by pulling against the levator action. The only excuse for using a Z is the longitudinal lengthening of the palate by bilateral transposition of flaps (the sum of the squares of the two sides of a right triangle is equal to the square of the hypotenuse) so that the palate would indeed be extended longitudinally. As in all Z-plasties, however, such lengthening is at the expense of transverse shortening, and if this dimension is already in trouble, as is usually the case, the problem is compounded with an overall loss—instead of a gain!
24. Palate Extension by Union of the Posterior Pillars

**Gustav** Passavant of Frankfurt, the father of operations designed to reduce the velopharyngeal aperture, in 1865 described a procedure which united the palatopharyngeal muscles in the posterior pillars of the tonsils for 2 cm. in the midline to effect the extension of the posterior velum back toward the pharyngeal wall. The upper portion of the mesial border of each posterior pillar was denuded and united by suture after lateral longitudinal incisions had been made in the anterior pillars. Speech was only slightly improved as nasal intonation persisted, as did Passavant in his search for velopharyngeal competence.

**Pillars Cut as Flaps**

In 1871 William Whitehead of New York attempted to lengthen the palate by adding to it two lateral flaps dissected from the posterior pillars and the lateral walls of the pharynx. Probably with beads of perspiration on his brow, he explained:

I endeavored by a difficult and laborious dissection of the palatopharyngeus muscles, to form flaps with which to lengthen the velum palati. Having seized, with a pair of forceps, the palatopharyngeus on the right side very low down, I divided this muscle and a part of the mucous membrane of the prevertebral region, and dissected upward with a pair of curved scissors a flap more than sufficient to form, with a corresponding one on the opposite side, a long and dependent curtain to the new velum.

In 1897 Senn reported using flaps from the tonsillar region to reconstruct the velum in a case in which the soft palate was
absent. In 1909 Brandt mentioned using flaps from the region of
the tonsils to close defects in the palate in children. In 1922
J. E. Thompson used oblique side cuts C-D and C'-D' through
palatoglossal and palatopharyngeal muscles to allow medial ap­
proximation of the remaining velum. He reported:

The reconstructed palate was firm and strong, although somewhat short and
stubby.

In 1910 Hyppolite Morestin of Paris, the octoroon from
Martinique with a volatility of kitten-to-tiger temperament,
lengthened the velum in a girl with defective speech after suc­
cessful closure of her palate cleft. He accomplished this feat by
suturing the posterior pillars of the fauces in the midline after
incising each side on the slant from "without and upward to
within and inward." He reported a satisfactory result.

In 1923 Makuen of Philadelphia incised through two-thirds of
the palatopharyngeus muscle on each side, approximated their
medial edges and used silver wire over lead plates to hold the
closure against tension.

**Radical Lateral Flaps**

In 1925 flamboyant Eastman Sheehan of New York admitted to
considerable loss of tissue in cleft palate failures following sur­
gery. He argued that the palate muscles had blended with neigh­
boring tissues and set out to find a way to use them. In a total
cleft he designed bilateral flaps based anterolaterally, taking tissue
from the pillars of the fauces, the tonsils and part of the lateral
wall of the pharynx. He noted:
The upper point of the incision is well above the superior horizontal line of the faucial tonsil. The incision is carried well toward the cheek, then directly downward across the tonsil to include its upper two thirds, then backward over the posterior pillar, to include about a quarter of an inch of the pharyngeal membrane, then up to a level with the original point of incision. . . . The muscles, membrane and tonsillar tissue within these borders is then deeply separated, by the use of a long semicircular scissors with blunt ends.

The two flaps were united in the midline, and the raw area in the faucial regions was lined with Thiersch epithelial inlay grafts shaved off the inner surface of the thigh. A dental plate with two bars carrying molded stents was used to maintain the grafts. The residual anterior hole in the hard palate was later filled with an obturator.

It is interesting that this procedure is a reverse of the Gillies-Fry operation using skin grafts with a stent and ending up with an obturator in the hard palate hole. Sheehan had spent time at Sidcup and no doubt was influenced by Gillies' work and teaching. He and Gillies became "friends," and this is what Gillies once told me over a cup of tea:

When the Nuffield Professorship in Plastic Surgery at Oxford University was under consideration, I was most anxious for the position, feeling it would be especially satisfying after having graduated from Cambridge. Eastman Sheehan had charmed Lord Nuffield sufficiently to become a strong contender and eventually he and I competed to a stand-off and my good friend Tommy Kilner became the Nuffield Professor.
Today Sir Harold Gillies’ portrait hangs beside that of Lord Nuffield at the Royal College of Surgeons, London.

JOINING THE POSTERIOR PILLARS

In 1912 Helbing, using a modification of Passavant’s principle, united the posterior pillars to increase the size of the velum by denuding the mesial border of the palatopharyngeus arch and extending this denudation over an intervening portion of the free border of the velum. An incision was then made on each side dividing the posterior pillars at the little "x." The denuded edges were united in the midline by suture aided by lateral relaxing incisions.

In 1944 Harold S. Vaughan of New York Post-Graduate Medical School resurrected Passavant’s principle and published his modification. His logic was impressive:

It must be understood that the palatopharyngei cannot be used to obtain sufficient horizontal elongation of the soft palate to permit elevation against the pharyngeal wall, as these muscles pass down the lateral wall of the pharynx somewhat posteriorly; they can, however, be made to move closer to the posterior pharyngeal wall and, by the assistance of the pharyngo-palatine sphincter, the muscles will approximate close enough to nearly close off the nasopharynx. In attempting midline union it is necessary to obtain complete immobilization of the palatopharyngei, and it is here that the silver ribbon is invaluable.

SANVENERO-ROSSELLI

Gustavo Sanvenero-Rosselli, a learned Italian of Milan, who accumulated a remarkable private plastic surgery library, often
revealed his knowledge of history. In 1971 he informed me that Paré, or one of his colleagues of that era, had exclaimed of a cleft palate that when the child was born, God was yawning: "Ceux à qui Dieu a bâilli des leur nativité."

In 1949 Sanvenero-Rosselli also advocated the principle of approximation of the posterior pillars of the fauces behind the uvula and in 1958 described the method at the Universities of Turin and Milan. In 1964 in Hamburg he emphasized his enthusiasm for this method, explaining it as a simple procedure for further elongating a previously operated velum when the post­erior pillars are not too far apart or too thin. As he said:

Without reopening the closed velum, without any additional scar or interruption or distortion of muscular bundles, we obtain elongation of the palate, such as to grant a positive improvement in its functional value.

In 1973 G. Sanvenero-Rosselli was honorary president of the Second International Congress on Cleft Palate held in Copenhagen. Poul Fogh-Andersen as secretary general had the Congress opened with a lur fanfare, explaining that this demonstration was not a new test for velopharyngeal incompetence. He elaborated:

These Danish instruments, made of bronze and called "lurs," are the oldest playable musical instruments in the world. There is something both musical and fascinating about these lurs, manufactured according to an outstanding casting technique 3,000 years ago, apparently always used as a symmetric pair, calling people together, just as you heard two minutes ago, or warning against enemies, maybe announcing religious ceremonies or possibly for entertainment as you will enjoy in a moment.
As soon as the sound of the lurs had faded, Sanvenero-Rosselli and Ernesto Caronni of Milan again confirmed faith in union of the pillars to lengthen the posterior palate 2 to 3 cm. beyond the uvula and added a uvula switch.

In an effort to contribute to a good velopharyngeal closure, the transposing of the uvula from the anterior (oral) face to the posterior (pharyngeal) face of the velum . . . has proved itself to be very effective. . . . Not only do we transpose the uvula, but with it a certain mass of muscle that remains in the cavity as a contractile protrusion, which often is determinant in assuring a good velopharyngeal contact.

In 1976 D. Rosselli and I. Minuto of Rome, in homage to Sanvenero-Rosselli’s memory, reported their use of the posterior pillar union in 120 cases with only 7 not recuperable, requiring a velopharyngeal flap. As further defense for the principle, they cited the 1972 work of J. Delaire, whose study of the normal palate demonstrated that behind the azygos muscle, situated below the palatopharyngeus, there is a considerable portion of the velum. On this basis he concluded logically that the reconstruction of the cleft soft palate must unite the muscular elements in the most natural way, and thus union of the posterior pillars reconstituted a condition similar to the normal.

In 1954 George T. McCutcheon, of Columbia, South Carolina, reported his use of Passavant’s principle at the time of cleft palate closure:

For some time we had considered the pharyngo-palatine muscles with the idea that their approximation in the midline would accomplish a muscular barrier to the onrush of air into the nose. . . . Since 1949, we have operated upon 75 cases. . . . The results have been encouraging. . . . Most have required no speech training, while a few have accomplished normal speech with minimal training.

Alberto Albertengo of Rosario, Argentina, in 1964 at the International Congress in Rome described his use of Passavant’s union of the posterior pillars. He diagramed with a broken line the edge incisions extending beyond the uvula along the inner border of the posterior tonsillar pillars.
Out of 150 cases, 95 percent had been totally or partially successful. Several final results are shown. He summarized his reasons for continued use of this approach.

1. This type of operation allows the palate to be lengthened a further 2 to 3 cm.
2. A dynamic and effective sphincter is obtained between the naso- and oropharynx.
3. The movements of the palate are not affected.
4. The quality of speech is found to be in direct relationship to the length of the palate obtained.
5. Because the technique is simple it can be done in the same time as the closing of the cleft.
6. If this operation is done in childhood, better results are obtained.
7. When operation takes place at early age, muscular action, in time, lengthens the short palate.

Radiographic demonstration of dynamics of the soft palate after operation: A-A’, Relaxation; B-B’, Activity.
Otto Neuner, oral surgeon of the University of Berne, Switzerland, in 1966 and again at the International Cleft Palate Congress in Copenhagen in 1973, advocated splitting the posterior edge of the velum and extending these incisions bilaterally along the edge of the posterior pillars. Through a crosscut at the level of the tonsil the finger is used to dissect under the lateral pharyngeal muscles and guide further extensions of the incisions in the lateral pharynx. Two-layer closure of the incisions in essence joins the posterior pillars behind the uvula. Neuner noted:

An improvement is attained in creating a new palatine fornix by a lateral detachment of the pharyngeal septum (mainly muscular tissue); the velopharyngeal ring is restricted to a narrow lacuna and the new roof shows great flexibility.
on 30 patients with a great improvement as regards to consonants but a lesser one as regards to vowels.

Neuner also used what he calls “an Arcus Palatopharyngoplasty,” which is a thickening of the posterior tonsillar pillars and diminishing of the velar opening by plication of the constrictor muscle in the fold.

This operation, Neuner reported,

either in one or two procedures [was] performed on 45 patients with speech improvement in most cases to normal phonation.

Robert M. McFarlane of the University of Western Ontario, London, Canada, is not unfamiliar with international competition. Not only has he entered the fray in cleft palate surgery, but he represented Canada in the 1948 Olympic Games in London, England, at 400 meters. His best time was 46.9 seconds, which
partly explains the problem he gives his house staff making rounds up and down the stairs of Victoria Hospital’s eight floors.

At the 1972 Las Vegas meeting of the American Society of Plastic and Reconstructive Surgeons, he and R. G. Colcleugh presented the most modern “Suture of the Posterior Tonsillar Pillars at the Time of Cleft Palate Closure.” He explained closing the palate with a pushback at 1 year with three or four mucoperiosteal flaps as described by Peet in 1961. After closure of the nasal layer of the soft palate, the incisions were made along the medial edges of the posterior pillars and they were sutured in two layers.

A broad web of soft tissue was thus created posterior to the uvula, as shown in his photograph. Here also are his radiographs of a 5-year-old unilateral complete cleft treated in the manner described. (A. Palate at rest, B. Voicing letter e, C. Voicing letter s.)

His summary was pertinent:

The results of this procedure were studied in twenty-three children operated upon for cleft of the palate at one year of age. The study consisted of clinical, radiological, and speech assessment. Eighty-three percent had acceptable speech four to six years later, and there was no evidence of interference with movement of the palate by the sutured tonsillar pillars.
In 1976, after reevaluation, McFarlane reported:

I still feel that it is a good procedure and I continue to use it routinely.

In 1973 at the Cleft Palate Congress in Copenhagen Cardoso da Rocha, a pediatric surgeon of Porto, Portugal, who had been interested in cleft palate for 20 years, advocated the procedure as sketched, noting:

Anatomic reconstruction making use of the pharingo-palatinus muscles facilitates not only a surgical reparation of the cleft palate, but also enables the best phonetics results, avoiding more open "rhinolalias."

In 1974, in the Journal of the Indian Medical Association, Murari Mohan Mukherji and A. Chanda of Calcutta advocated tonsillectomy for large and infected tonsils as an aid in surgically uniting the posterior tonsillar pillars during a V-Y palatoplasty. They wrote:

Posterior pillars of the fauces have been stitched up starting from the inferior margin of the uvula for about an inch. The uvula hangs like a ceiling lamp from this elongated soft palate. This partial apposition of the posterior pillars of the fauces not only elongates the soft palate but also constricts the nasopharyngeal aperture. Both these acts help in closure of the nasopharynx for the production of satisfactory speech.

**VOTES AGAINST THESE UNIONS**

The principle of uniting the posterior pillars of the tonsils has never appealed to me. It may give superior-inferior velar length but does not, in my opinion, give the coveted anteroposterior
lengthening. In our Miami cleft palate clinic in November 1976 we were discussing a patient who had had the posterior pillars united behind the uvula years before in another unit. The speech was poor. David Dickson, our speech analyst, was asked how he felt about the physiology of the pillar union. He expressed disdain, explaining that it might aid swallowing by extending the swoop of the funnel, but in speech it reduced the resonance by dividing the oral and nasal cavities at the wrong point and actually was detrimental to velar movement because of the inferior tethering.
25. Early Crude Palatal Pushbacks; Transverse Releasing Incisions

ROUX

In 1825 Roux used a transverse incision on each side of the cleft through full thickness of the velum, extending outward to the pterygoid plate. This released the palate from its attachment to the palatal plates and facilitated closure of the soft palate cleft.

PASSAVANT

In 1878 Passavant designed a pushback of the palate. Lateral incisions 1 inch long on each side mesial to the hamular process and running forward parallel with the alveolar margin were
joined with a transverse incision across the palatal mucoperiosteum. The quadrilateral flap thus inscribed was freed from the underlying bone. The entire velum was displaced backward and held with sutures to the posterior pharyngeal wall. Defects in the hard palate were closed at a subsequent operation and, according to Passavant, this procedure produced satisfactory results. Yet he eventually turned to an obturator.

In 1879 Passavant advanced the velum backward by a transverse buttonhole incision maintained with a stud-shaped obturator similar to the collar-button obturator previously designed and used by Gariel.

In 1886 Gussenbauer is reported to have made a transverse through-and-through incision at the junction of the soft and hard palates which he closed longitudinally.

SMITH

H. L. Smith of Nashua, New Hampshire, did a palate pushback procedure in 1895 that permitted the velum to touch the pharynx. Two mucoperiosteal flaps with their bases posterior were dissected from the bone and cut free from the edge of the hard palate to allow a true lengthening. The edges of the cleft velum were freshened and joined by sutures in the posterior position. The remaining mucoperiosteum was freed as two flaps, based anteriorly, and swung medially to unite in the midline and join the pushback flaps. This was the precursor of the four-flap pushback of Wardill.

GRIFFITHS

Another pushback, by Joseph Griffiths of Cambridge, England, in 1913 separated the mucoperiosteum from the hard palate, carrying the lateral incisions right forward until they reached the edge of the cleft alveolus. They were united after paring without tension, but the surgeon was not concerned that these loose flaps did hang down onto the tongue for a time. This and the pushback of Smith are the predecessors of the V-Y.
In 1918 J. B. Roberts of Philadelphia used a curved incision across the palate vault in the region of the canine teeth and elevated the mucoperiosteum, freeing the velum. The mucoperiosteal apron thus furnished, suspended from the hamular processes, allowed the velum to be displaced backward like a sling and held with sutures. This was a predecessor to the Dorrance horseshoe-shaped pushback.

**GILLIES AND FRY**

The best known of the early true pushback operations was that of Gillies and Fry. In 1919 when Gillies first became interested in cleft palate, there were three methods in general use: Lane, Brophy and von Langenbeck. On his first visit to study Lane’s work, Gillies gazed with awe at the skill of this master. On subsequent visits he began to see that the large raw mucosal flaps turned to close the gap were responsible for a tight, scarred palate, maxillary distortion and poor speech. Brophy’s principle of compression did not appeal to Gillies because he had already abandoned the concept of pulling together an otherwise normal arch in order to close the maxillary gap, and even then it was evident that unoperated palates had relatively normal occlusions of the uninvolved teeth. The von Langenbeck operation produced a short palate which was too tight in wide clefts.

By this time his dental friend Kelsey Fry, who had joined him at the Plastic and Jaw Unit at Aldershot, England, had demonstrated the ease and efficiency of dental closure of traumatic gaps in the upper jaw.

Before joining Gillies, Fry had had a pretty lively time as a regimental medical officer in the front lines during World War I, receiving the Military Cross and eventually a knighthood. As Gillies and I wrote in 1957:

At Festubert, he dragged a wounded colonel across no man’s land, picking up a sniper bullet in his own arm. Then he experienced a tragedy which probably had a part in saving many a life thereafter. A young lieutenant, who had his jaw blown out during a night raid, staggered into the dugout
soaked in blood. Captain Fry led him along the trench to the aid station, forcing the lieutenant to lean on him, keeping his head forward to allow blood and bits of bone to fall free of his airway. The lieutenant was turned over to the medical orderly and as his condition seemed good, Fry started back up the trench. He had not gone fifty yards when word came the lieutenant was dead! Investigation revealed the lieutenant had been laid on his back on a stretcher and died immediately of respiratory obstruction. Fry had to wrap him in a blanket and bury him in the mud that night.

He subsequently started a warning campaign to the troops about the importance of keeping the face down and the airway open in mouth and jaw wounds, just as recovery room personnel today care for postoperative cleft palate patients.

Gillies and Fry worked together in friendly cooperation during the rest of the war and were responsible for many advancements in plastic surgery. After the war they set out together to try to design a combined method that might let the cleft palate patient not only speak well and eat well but look well. They published their pushback operation in 1921. By separating the soft palate halves at their junction with the hard palate, but retaining the levator action, Gillies pushed back these halves as far as possible and joined them into a new soft palate able to touch the pharynx in an efficient sphincter. Fry constructed an immediate apparatus to stretch the soft palate during the healing phase and later covered the hard palate defect with a plate and fitted an obturator in the gap between the hard and soft palate.

Their first patient was Bill Booker, who got a 100 percent speech result. Twenty-nine years later, Sir Harold Gillies was scheduled to speak on cleft palate at a meeting at the Royal College of Surgeons, Lincoln’s Inn Fields, London. He sum-
moned Booker and secretly planted him in the back of the audience. At the end of the lecture Gillies called on Booker at the back of the room, and they had a to-and-fro conversation during the entire extent of which not one honorable medical member suspected this man of having a cleft palate. Finally Booker removed Fry's great obturator and passed among the astounded crowd with his mouth wide open, revealing the large hole.

Subsequent refinements which reduced contracture and produced more mobile soft palates included mucosal flaps turned off the hard palate to be folded over the posterior edge of the soft palate and Thiersch grafts on a gutta-percha dental mold to cover the raw areas on the hard palate.

When I joined Gillies the first time in 1948, he let me do a Gillies-Fry pushback on a short, scarred secondary palate in a veteran who had been the British Army lightweight boxing champion during the Egyptian and Italian campaigns. After a cap splint had been fitted (A), the soft palate was divided from the hard palate along its posterior edge, producing a gaping hole (B). An obturator carrying a split-skin graft, raw surface out (C), was fixed into the hole, and later an obturator was constructed to fill the hole and maintain the soft palate pushback (D).
The method definitely pushed the soft palate back with greatly increased length, but, obturator or not, I hated the hole. Of course, the main drawback to the Gillies-Fry procedure was the necessity of an obturator. Gillies admitted there were pros and cons, and two cases are cited.

**Pro**

The enormous weight of the obturator and denture required by the Gillies-Fry pushback in one woman golf champion, besides providing nearly perfect speech, perhaps helped her keep her head down in putting and her eye on the ball!

**Con**

There was one patient who had had a Gillies-Fry pushback and a Wardill pharyngoplasty, but the boy’s speech, particularly the sibilants, did not improve according to expectations. He could blow a trumpet, but his inability to reach certain high notes was extremely trying to listeners. Gillies recalled in 1953:

Then in the North African desert in 1945, his obturator broke and the Engineer Corps sent it back to him with a marked ridge at the weld, \( \frac{3}{4} \) inch back from the centre of his teeth. This was the very “talking point” his tongue had been looking for—his speech is now almost perfect.

One case of a Gillies-Fry procedure remains unforgettable. The patient’s name was Ernie Jackson, and the case history began during St. George's Grand Challenge Cup at Sandwich, England, where in a field of 80 Harold Gillies tied Roger Wethered. They were playing it off on Sunday and broke even the first two holes. The tension was mounting as there came a holdup at the third tee. During this temporary delay the local doctor came out of the spectators and, sidling up to Gillies, whispered:

Would you mind, sir, having a look at one of my patients?

This is Gillies’ account as he reminisced years later:

As there seemed to be some time before we could tee off, I went with the doctor to meet Ernie, who was a 15-year-old caddie with a very tight upper lip.
During the introduction, Ernie hung his head and mumbled a greeting through his nose. Without looking into his mouth, Gillies could imagine the short scarred palate, trying in vain to reach the pharynx. Eventually, a buccal inlay freed Ernie's lip and nose, a Gillies-Fry pushback freed his palate and a denture with an obturator had a remarkable effect on his speech. As Gillies recalled:

From that time forth, I was never allowed to golf in the vicinity of Sandwich without Ernie as my amended caddie.

In fact, Tom Webster, celebrated British cartoonist and friend of Gillies, combined Gillies' famous high tee with Ernie the caddie in a 1924 sketch.

Then more sophisticated pushbacks achieved lengthening without an obturator and Gillies saw his procedure discarded like an old shoe. He admitted in remorse:

I felt that I had unnecessarily condemned my palates to an obturator life with all its attendant difficulties.

Thus, when Gillies began putting tube pedicles into the palate in the early 1950's, we wrote:

One obvious group of tube pedicle candidates are all Gillies-Fry cases, condemned to wear a huge obturator, which necessitates constant dental supervision, irritates the nose, often lodges food and, when the teeth are gone, will not stay up in position. . . . While the dental obturator is in, the patient may be the life of the party, but upon its removal he becomes a social outcast.

After over four decades of brilliant service to his country and the College, one might expect that following his death Sir Harold Gillies' portrait would be hung in the front hall of the Royal College of Surgeons, along with such of his friends as Sir Gordon Gordon-Taylor. Yet Gillies, only able to suffer formality for short periods and always game for a good-humored prank or a pint of bitters with the boys, would not have had it that way. Thus, if you climb several flights of stairs and pass through numerous back corridors, you will come upon a bar frequented by Fellows in the College and most often by the younger mem-
bers. It is here that Howard Barron's portrait of Sir Harold hangs, and on his right is the portrait of Lord Nuffield, a longtime friend of his and of plastic surgery.

The other member of this dynamic duo, Sir Kelsey Fry, with his skill at constructing effective obturators, made primary veloplasty possible but saved many maxillae from collapse. Margaret Hotz recalled how he had said that if he had a cleft, he would want the soft palate closed but would allow the hard palate closure only if it caused no forward pull on the velum. During his later years Fry found great enjoyment in growing carnations—not the usual odorless reds and whites sold commercially, but special ones giving off especially fine perfume.
26. Refining the V-Y Palate Retropositioning

GANZER

In 1920 innovative oral surgeon Hugo Ganzer of Berlin pointed out that the von Langenbeck operation left the patient with a short velum. He also noted that paring the edges wasted a valuable 2 mm. of tissue. Therefore he designed a closure in two layers after splitting the edges. He was the first to execute a V-Y type of retropositioning of the palate with a gain in the overall length of about 1 cm. This principle was to have an important influence on palate surgery.

HALLE AND ERNST

Franz Ernst pointed out that in the cleft palate patient the nasopharynx was wider and the maxillary halves were smaller than in non-cleft patients. He observed too that the nasopharynx in cleft palates was longer in the anteroposterior dimension. Then Halle, in a paper to the Laryngological Society of Berlin in 1922, noted that the usual cleft palate operation produced a shortened palate. He reported that since 1915, following the suggestion of Ernst, he had been retropositioning the palate 1.5 to 2.0 cm. Ernst had proposed that a circular narrowing of the pharynx could facilitate the velar approximation to the pharyngeal wall. In 1925 Halle published further details of this procedure.

The edges of the cleft were split for a two-layer closure. The long lateral relaxing incisions were made from the incisors to
well behind the last maxillary molar tooth and extended back and down to terminate in the palatopharyngeal arch mesial to the last mandibular molar tooth. An elevator was introduced into the space of Ernst behind the superior constrictor muscles of the pharynx; the space dissected was packed with iodoform gauze to push the lateral walls of the pharynx medially. The gauze was changed from time to time until the cavity had filled with granulation tissue. During this phase the mucoperiosteum behind the central incisors was divided in two stages (dotted line) with small incisions until complete release allowed posterior displacement. The celluloid plate of Ernst was used to protect the palate during the healing phase.

In complete clefts of the palate, Halle and Ernst carried out the same closure and radical release with subpharyngeal wall packing but used the V-Y incision of Ganzer anteriorly for more posterior displacement.
He condemned the Axhausen method and then leveled a scathing attack on von Langenbeck:

Langenbeck's method results in short immobile palates due to sclerosis caused by cicatrization of a large bleeding surface on the nasal aspect of the palate which, in turn, is related to the wide undermining necessary in order to lower the flaps.

He backed his attack with final proof, by analysis of his results by his speech therapist, Mlle Borel. She reported speech effects twice as good as any published by von Langenbeck.

A counterattack was led by a formidable antagonist, Erich Lexer, another of the German giants of surgery. In 1927 he
condemned Veau’s principle of suturing the nasal mucosa, arguing that leaving an open wound on the nasal side maintained drainage and prevented the accumulation of pus between the united muscle layers of the palate.

Preferring his own modification of the von Langenbeck method, Lexer referred to Veau’s procedure as

the French method which works only for Frenchmen who speak with the mouth but not for Germans who speak with the throat.

Veau, suspecting that Lexer had never tried his method, sent him a copy of his *Division Palatine* with an invitation to come to Paris. Lexer responded, "I shall not cross the Rhine!" It was then that Veau, with his typical savoir faire, sent a Parisian invitation to Mrs. Lexer and their two daughters. In 1932 all the Lexers crossed the Rhine! They were wined and dined in Burgundy and then taken to Paris, where Lexer was shown an astounding number of clefts collected for his examination. Mlle Borel played impressive comparative sound tracings recorded on the patient’s diction preoperatively and postoperatively. Led to the operating room Lexer then was assisted and supervised in a Veau palate operation by Veau! The following year, when Veau visited Lexer in Munich, he found that the great German surgeon was using his method.

Veau’s first-stage closure turned vomerine flaps for nasal lining and mucoperiosteal flaps to overlap partially this one-layer clo-
sure. In the second stage or in soft palate clefts, Veau used a modified Ganzer V-Y closure of the oral mucoperiosteum without actually lengthening the nasal mucosa or dividing the posterior palatine vessels. He placed a metallic suture around the muscles with a Reverdin needle.

LeMesurier

In 1935, in the *Canadian Medical Association Journal*, A. B. LeMesurier of Toronto published his use of Veau's operation in incomplete clefts of the palate and in complete clefts.

Veau's influence was worldwide, and his general principles are still popular today.

*Personal observation*

In the summer of 1948 I went over to the Continent for a month and in 1950 recalled:

In Paris, not far from Gare St. Lazare, I found the flat of Victor Veau. A saucy French maid ushered me into a dimly lighted room with the curtains drawn. I was left to feel my way along the wall and finally sat down, not without a start, on a lion skin with its snarling head draped over a couch. Presently, the gaunt and ailing Veau, in silk robe and gray goatee, came rushing in, kissed me on both cheeks, gave me three reprints written in French, a requested photograph of himself and invited me to return again one day. I did not even get a chance to ask if he still used wire for his "suture musculaire."

At l'Hôpital Saint-Michel, where Veau did much of his later palate work, I found Jacques Récamier. He explained that Veau's
lip and palate technique, except for insignificant detail, had not changed for many years. In fact, the technique I saw Récamier use seemed identical to that described by Veau in 1927.

Less than a year later, on May 16, 1949, the sympathique Victor Veau had died of the illness incapacitating him during my visit. All the cleft palate world mourned his passing. Jacques Récamier at l'Hôpital Saint-Michel and Pierre Petit at l'Hôpital Saint-Vincent de Paul carried on his great work.

PETIT

At the 1964 Hamburg International Symposium, Pierre Petit of Paris, once a student of Veau, described the method he used as that of Veau with a few changes. He outlined the different stages of the procedure:

1. The medial edge of the soft palate is divided longitudinally
2. The two palatal mucoperiosteal flaps are dissected and the two neuro-vascular bundles elongated
3. The hamuli are infraacted. The palatal aponeurosis is detached and the nasal mucosa liberated and pushed medially.
4. The dorsal [nasal] mucosal layer is closed (from the anterior to the posterior part) by catgut sutures, leaving the knots exposed nasally
5. The buccal mucosal layer is closed and muscle simultaneously sutured from back to front with silk mattress sutures. Then the mucoperiosteal flaps are fixed to the roof of the osseous palate to avoid any dead space.

LIMBERG

In 1926 at the convention hall in Philadelphia an International Dental Congress was held, and many famous palate surgeons — Brophy, Gilmer, Ivy, Blair and Brown — were there. Dorrance explained his 1925 pushback procedure. Then a Russian named Alexander Limberg presented a variation of the V-Y pushback, which he published in 1927. Limberg used the Halle-Ernst design with the Ganzer V-incision and Blair's soft palate release(x), and advocated interlaminal osteotomy of the pterygoid process and pterygomaxillary osteotomy. He criticized Halle and Ernst for dividing the posterior palatine vessels and nerves. To facilitate the lengthening maneuver and preserve the neurovascular bundles, he proposed ostectomy of the bony palate wall of the foramen with
a chisel or bone-cutting forceps, removing a section of bone mesially and posteriorly. This ostectomy of the posterior wall of the foramen enjoyed popularity for many years and even today is used in some clinics.

In 1959 I had a chance to visit Limberg in his Leningrad clinic, see his patients and discuss his method of lengthening the palate. He was most proud that he postponed final palate surgery until about 10 years of age to protect teeth and maxillary growth, a conservatism natural in a surgeon with his dental background.

WARDILL

William Edward Mandall Wardill had become intrigued with the problem of cleft palate during his association with Professor Gray Turner. Turner’s speech results were appalling, and his claims of a considerable proportion of “normal speakers” appeared dishonest. Cognizant of Turner’s high integrity, Wardill suddenly realized that the professor was hard of hearing and not acute enough to pick out the faults in the speech of his patients. Wardill began to study the anatomy and physiology of normal and cleft palate individuals. In 1928 he described a palatal insertion of the superior constrictor muscle of the pharynx. It was confirmed two years later by anatomist Whillis, who labeled the pterygopharyngeous portion of this muscle inserting into the palate the “palatal pharyngeal sphincter.”

Wardill, however, continued to follow the teaching of Gray Turner and cut his flaps according to the von Langenbeck method but adding his “transverse-to-longitudinal” pharyngoplasty. He spent hours trying to teach his patients to speak correctly, and finally it became obvious to him that a better surgical design was needed. To get the best results, he felt, the operation should be carried out before speech age since once the patient learned incorrect speech habits the difficulties increased a hundredfold. Yet this early surgery seemed unattainable at the time since Ian McGill had not yet developed endotracheal anesthesia.

Over the next few years Veau’s influence had extremely beneficial effects across the Channel, for by 1937 Wardill in Newcastle upon Tyne and Kilner in London upon Thames independently
published more radical and perfected V-Y retropositioning operations than what had originally been described by Veau. Whether justifiably or not, more often than not this principle bore Wardill’s name. Yet Kilner’s rendition probably enjoys more popularity today. Wardill and Kilner remained friends through it all.

In 1937, in the widely read and respected *British Journal of Surgery*, Wardill, following Veau’s suggestion that raw surfaces should always be covered (at least over parts concerned with the movement of the soft palate), described his dissection of the mucosa from the nasal surface of the hard palate edges. He fractured the hamulus, divided the posterior palatine vessels and modified Ganzer’s V-Y by transecting the mucoperiosteal flaps in their mid-length to ensure adequate blood supply. By freeing and stretching the nasal mucosa, he obtained about 1 cm. in apparent length at the operating table. He used a three-flap method for incomplete clefts. Then, for a complete cleft, he chose a four-flap procedure, shown here in detail, continuing to use his pharyngoplasty in conjunction with his semi-lengthening procedure.

As I wrote in 1950:

Socialized medicine was scheduled to take over in Great Britain July 5, 1948. As this time approached, it was rumored that Wardill was emigrating to South Africa. When it was reported he was finishing up his waiting list of prostates and palates, I caught the night train to Newcastle and was waiting in his nursing home. Luckily it was a palate day. He arrived in high rubber boots, said “If anyone has just cause why these two palatal edges shall not be joined together, let him speak now or forever hold his peace,” and proceeded to do a V-Y closure. I noted the main differences were that he hummed while he worked, divided both posterior palatine vessels and did a pharyngoplasty routinely on all cleft palates.
KILNER

Also in 1937, but in the more local *St. Thomas Hospital Report* and then in *Postgraduate Surgery*, T. Pomfret Kilner described a remarkably similar and possibly better procedure. The important difference lay in his refusal to divide the posterior palatine vessels, depending on freeing them from their attachments around the foramen. He did not consider the pharyngoplasty necessary in all cases. He gave Veau special credit, mentioning

free separation of nasal mucoperiosteal flaps and approximation of these as far as possible throughout the cleft . . . employment of vomerine flap or flaps, when available, to assist in this nasal closure [of hard palate] (Veau).
As he wrote in 1937:

I have freely borrowed from the work of my contemporaries, gradually evolving a procedure which for several years now has been giving me most gratifying results at the Princess Elizabeth of York Hospital for Children, Shadwell.

The essential points may be summarized as follows:

1. Pharyngoplasty (Wardill).
2. Rotation flaps from the hard palate (Veau).
3. Extensive freeing of the soft palate tissues from the posterior borders of the palatal process (but no division of the mucosa!).
4. Hamular process fracture, a procedure introduced many years ago by Billroth and re-introduced by Wardill and certain American workers (Dorrance particularly) in comparatively recent years.
5. Free separation of the lateral pharyngeal wall from the internal pterygoid plate and its immediate neighbourhood (Ernst and Ahausen). . . .

. . . The reference after each is given not as indicating so much the original introducer as the surgeon in whose work I first observed this part of the technique.

Kilner also acknowledged:

Wardill has recently introduced what he has described as a "four-flap method," and I have found this useful for closing wide clefts which extend far forward.

An Oxford dynasty

Kilner's meticulously skilled technique, set routine, congenial teaching of the transient foreign student, tyrannical schoolteaching of his own house staff and assistants, aided by the prestige
of his Nuffield Professorial throne at Oxford and its convenience by rail and road from London, brought him a stream of students, old and young. Those who came to watch returned home inspired to try to duplicate Kilner’s precision. As Marcks, Trevaskis and Tuerk of Allentown, Pennsylvania, stated in 1955:

Soft palate clefts and partial hard palate clefts are repaired exactly as described by Kilner.

Even at his last palate operation before his retirement, as seen in a memorable photograph kindly sent me by Kernahan, Kilner was surrounded by observers. It is interesting to see him in his characteristic seated position with the patient’s neck extended and his head reclining almost in his lap.

More important, he produced a dedicated core of second-generation captains who have carried out the tradition of the V-Y Corps to the third, and now even the beginning of the fourth, generation. Kilner kept fastidious records, but balked during his later years at the task of compiling these into a book, and the same task has been bypassed by others. Possibly a fifth-generation surgeon will go back and correlate the vast experience recorded by Kilner at Oxford and Alton.

Personal experience

By 1948 I was training with Gillies, but since his palate surgery was confined mostly to secondary work, I used weekends, holidays and odd times to visit other palate surgeons.

Every other Saturday, Kilner and Peer took off from Oxford to put on an exciting cleft lip and palate show at Lord Mayor Treloar Children’s Hospital, Alton. From Basingstoke it required a two-hour ride on a red double-decker bus through English countryside to arrive for the morning clinic. Here Professor Kilner, with a carnival blower and an attentive ear, demonstrated the excellent velopharyngeal closure and speech results of his palates. "What is this, little boy?" asked the professor, pointing to a cigarette and listening for the coveted sound of “s.” "Fag!" said the complete group III bilateral cleft lip and palate, grinning on his slightly prominent premaxilla. It was estimated that 80 percent of his palates could pronounce s quite nicely.
In the operating theater when the genial little professor sat down to a cleft palate, all nationalities collected about him like drones buzzing around the queen bee. I became quite adept at working my way through the Indians, Italians, Belgians and British in order to see a technique carried to its perfection. Kilner reveled in honing a routine to regimental precision. Once I was allowed to scrub in as first assistant and experienced his knuckle-cracking instruction, as he indeed turned into a tyrant when in the theater.

It was thrilling to watch Kilner or Peet develop the V-Y flaps, stretch the posterior palatine vessels out of their foramen, dissect the nasal mucosa from the medial pterygoid plate and along the posterior border and free edge of the hard palate. This freeing of the soft tissue from the bone, which the professor called “filleting,” when completed on one side revealed at least a temporary gain of 1 cm. in length as compared to the unoperated side. Emphasizing the importance of this dissection and his preference for it, Kilner would describe how he had observed Victor Veau place his “suture musculaire” and then cry “Tirez! Tirez!” as he dragged the palate halves together with force. One of the most disciplined aspects of Kilner’s surgery was his suturing. He used the French Reverdin needle, which although a little too big for fine suturing was extremely well adapted for awkward closure of the nasal and oral palatal mucosa. He would place an entire row of sutures for one layer and hang them in an orderly array on the spring coil on his gag. Then he would tie them all and cut the ends before placing the next entire row of stitches.

REIDY

Joseph P. Reidy, a student of Kilner, presented as his Hunterian Lecture in 1957 an exhaustive study of 370 personal cleft lip and palate cases. He favored Kilner’s V-Y retropositioning and, comparing it to von Langenbeck’s method, said:

It must appear obvious that detachment of palatal flaps anteriorly will allow more movement of flaps in a posterior direction in the V-Y procedure.

He reported some interesting statistics on the primary use of the V-Y palate procedure: In 1949 Oldfield (another Kilner student)
reported 113 cases with 61 percent normal speech, 32.8 percent fair; in 1957 Reidy reported 193 cases with 77.2 percent normal speech, 20.2 percent fair.

Reidy concluded with the observation that the plastic surgeon is concerned with early palate repair and normal speech, while the orthodontist bemoans alveolar collapse following early palate surgery. Meanwhile the parents worry about appearance. The patient is in danger of becoming a misguided missile moving back and forth between the surgeon and the dentist. Reidy suggested that the orthodontist and surgeon change places in time:

Early correction of the arch deformity [should be] followed by later repair of lip and palate.

Pigott, who trained under Reidy and gained much from his discipline, recalled:

Reidy was enormously experienced, quick, methodical, unquestioning of Kilner dicta. I never saw him make a palate fistula in five years. When I would be absentmindedly sucking up blood somewhere away from the field he was working on, he'd say, "Suck, suck, suck, no, suck here—use it like a search light, not a vacuum cleaner—I can get charwomen at ten a penny."

In 1962 Reidy set 1 year as optimum time for palate closure, Kilner V-Y retropositioning as the primary procedure and Hynes pharyngoplasty as the secondary procedure of choice. Under these circumstances he recorded a failure rate of 20 percent and noted:

There is no doubt that scarring following breakdown, minor perforations, or repeated surgery plays a great part in reducing mobility of the palate.

PEET

Eric Peet, who was trained by Kilner, (and became his heir as director of the Nuffield Department of Plastic Surgery at Oxford), perfected the Kilner method. He executed his surgery with the same precision that he used in constructing stringed instruments in his free time, his last remarkable feat being the completion of a quartet of two violins, a cello and a viola. Peet presented what he termed the "Oxford technique" to the American Society of Plastic and Reconstructive Surgeons in 1961, citing his 500 cases of primary palate repair over the previous 20 years. As he explained:
Most of us are influenced by our early teaching and by those men we respect, under whose guidance we have served our early apprenticeship. . . . One's tendency has been to try gradually to improve the technique rather than alter it.

Quite lucidly, he described the paring of the cleft edges, stab incision and fracture of the hamulus with a Cumine's scaler, V-Y mucoperiosteal incisions and dissections of the mucoperiosteal flaps from the bone, mobilization of the nasal mucosa with the sharp and blunt crochet and Wallis's finisher, better known as the "golf club." He emphasized the importance of the dissection of the muscles medially from the medial plate of the pterygoid down to the base of the skull and the division of the palatal aponeurosis along the edge of the hard palate to give the backward release. The effective lengthening is seen after one side has been dissected.
The first suture in the closure, destined to be the anchoring stitch, was a 3-0 chromic catgut mounted on a small, curved Reverdin needle and passed through the nasal mucosa anteriorly. The nasal layer was then closed, and mattress suturing of the buccal layer followed. The final key tie was a figure-of-eight of the anchor stitch. Iodoform gauze packing was inserted on the medial side of the medial pterygoid plate.

The four-flap method was used for clefts extending well forward in the hard palate and for complete clefts after the anterior portion of the cleft had been closed previously with a Veau vomerine flap.

It was also used for complete bilateral clefts, the vomerine flaps being employed for nasal closure.
With this technique Peet reported, in 1961, 82 percent normal speech results in a series of 107 patients operated on between the ages of 12 and 15 months.

C A L N A N

Another of the elite Kilner Corps is James Calnan, professor, Royal Postgraduate Medical School, Hammersmith Hospital, London. A critical thinker with a bit of the rebel in him, he sometimes enjoys challenging accepted tradition. While still at Oxford under Kilner in 1954, he sided with Veau to destroy the myth of the importance in speech of Gustav Passavant's pad.

For the fine book by Grabb, Rosenstein and Bzoch published in 1971, Calnan described each step of the Kilner V-Y palate operation previously presented by Peet, in identically meticulous detail. One variant was his preference for the spoon-shaped Mitchell trimmer for hamular fracture and flap elevation. Also, in one of his diagrams during the early suturing, Calnan shows the limited extent of the actual posterior lengthening following complete dissection—the shaded distance between the hard palate edge and the folded-back mucoperiosteal flap.

It is of interest that in 1960 Calnan questioned the consistent effective long-term lengthening achieved by the V-Y pushback. In 1971, after 245 cleft palate operations on infants, Calnan reported a mean age of 13.4 months and an incidence of fistula at the posterior border of the hard palate of 11.4 percent. Speech
results were assessed at 75.5 percent ± 2.74 with normal articulation and 64.4 percent ± 3.06 with no escape of air down the nose (mist on mirror). As to actual posterior lengthening, Calnan is a little more optimistic:

However, a radiological study on a limited series of adults with cleft palate has shown that some lengthening of the velum is obtained, although the amount is usually less than 8 mm. Perhaps of greater interest was the finding that the amount of lengthening obtained at operation was inversely related to the original length of the soft palate.

INNES

Frank L. F. Innes of Norwich, England, is also a member of this elite line, having had both Kilner and Peet as his mentors and having been influenced by Calnan, another of their students. In 1976 he wrote:

The operation which I have always done for the primary repair of the cleft palate is the Kilner-Wardill operation and I am satisfied with this procedure. This operation does not push back the soft palate very much, but it does permit the soft palate to rotate upwards towards the roof of the nasopharynx. The maximum upward rotation is obtained if the palatal muscles are freed deliberately and radically, not only from the hard palate but also from the nasal mucosa. . . . The upward rotation of the soft palate enables it to make firm contact high up in the nasopharynx, which is where its point of contact in the young child should be. In older patients the soft palate makes contact with the posterior wall of the pharynx at a lower level, a little above the line of the floor of the nose . . . . If a surgeon has a failure rate with speech of more than 15–20%, he ought to question the type of operation which he is doing and whether he is doing the operation at the optimum age. I am unable to offer a definition of speech standards, but I find it hard to accept a result which is in any respect short of normal.

BATSTONE

And unto the third generation of Kilner through the teaching of Peet, suave country gentleman-surgeon John H. F. Batstone, living in a sixteenth century Elizabethan cottage (complete with authentic prisoners' stocks) near Oxford University, has taken over as cleft chief at Churchill Hospital where Kilner and Peet
once reigned. Trained in the standard V-Y by Peet but partially uprooted from this routine during 1966 while a Robert W. Johnson Fellow in Miami, Batstone has become what Kilner would have considered enough of a renegade to sentence him to a stint in his own stock. It is true he still champions the V-Y, but, as he said after a ski on Biscayne Bay in Miami in 1977:

The key is flexibility. In the complete cleft I close the lip and the anterior palate at 3 months—using a Stellmach vomer flap for the anterior palate, and rotation advancement for the lip. At 6 months the rest of the hard and soft palate cleft, if favourable, is completely closed by a 3- or 4-flap V-Y retroposition technique. If unfavourably wide, however, then the soft palate only may be closed at this stage, with an interval of several years (with or without a plate) before closing the residual hard palate cleft. Often it is found that the gap has narrowed sufficiently over the years to make a Langenbeck procedure both practical and effective. If the palate is still short, then a V-Y procedure is relevant and one might slip in an island flap at this time. When there is palate involvement only, as in the post-alveolar clefts, then I often revert to the simple Langenbeck method so as to achieve closure with a minimum of dissection and interference. Later on, in all grades of palate cleft where there is a persistently unacceptable degree of "nasal escape" speech, some form of pharyngoplasty becomes obligatory. At present I am not over-enthusiastic about most types of flap pharyngoplasty, but encouraged by use of retropharyngeal silastic implants inserted via a lateral incision.

**V-SPLIT FLAP PUSHBACK**

When there was only moderate shortening of the velum, Hamilton Baxter of Montreal in 1942 combined the Ganzer V-incision with the Barrett Brown horizontal splitting dissection under the mucoperiosteum leaving a layer of scar tissue beneath. He warned that much of the lengthening would be lost following contracture of the raw surface on the nasal side.
Nova Scotian Harold S. Vaughan of New York, in 1944 in *Surgery Clinics of North America*, described his method of V-Y pushback in complete clefts. His first two stages involved closure of the posterior part of the cleft, then the anterior portion. This was followed by a variation of the V-Y principle in a two-stage pushback. First he made incisions on either side of the previously closed cleft in the bony palate, leaving a narrow bridge of tissue, and then made lateral incisions along the line of the alveolar ridge through which the mucoperiosteum was elevated. The mucoperiosteum was replaced and held loosely by sutures for three or four weeks.

Then Vaughan re-elevated these two mucoperiosteal flaps and divided them from the palatal aponeurosis, leaving a rim of tissue at the posterior edge of the hard palate. He fractured the hamulus but did not divide the nasal mucosa, consequently limiting his lengthening. Finally he advanced his mucoperiosteal flaps in a V-Y action, suturing them to the midline section of tissue.

**Hynes**

In 1954 Wilfred Hynes of Sheffield, England, advocated less traumatic V-Y palate closure. He started with a Hynes pharyngoplasty and then outlined the principles of his palate closure:

a. The attachments of the palatine aponeurosis to the posterior borders of the bony elements of the hard palate are not disturbed.

b. The lateral pharyngeal dissections are avoided and the levators palati are therefore not exposed.

c. The anterior attachments of the upper part of the superior constrictor to the hamular processes, to the posterior borders of the internal pterygoid plates, and to the palatine aponeurosis are left intact.
d. The attachments of tensores palati to each side of the anterior part of the palatine aponeurosis are not interfered with.

**PINTO**

In 1972 H. S. Adenwalla of Trichur, India, wrote of his former chief Charles Pinto’s experience with the V-Y palatal procedure:

His execution of the palate was on the well-tried principles laid down by Veau and Wardill and the technical improvements made by Kilner and Peet. In his last year he began to do less and less of the “four flap” operation and began to teach the advantages of the “two long flap” operation which we now call the “Pinto modification of the Wardill repair.” This eliminates the weak point at the junction of the anterior and posterior flaps, the commonest site for the formation of a fistula. We in this department do not do routine culture examination on palates. In spite of this we have not had a single fistula in the 57 consecutive cases operated on since January 1971 by this modification. He did not have time to evaluate his own results with this “two long flap” operation, though he anticipated the elimination of breakdown and fistulae. We do not perform the “four flap” operation anymore.
KERNAHAN

Early palatal mucoperiosteal flap dissections have been blamed more and more as possible causes of retardation in maxillary growth with subsequent deformity. The mucoperiosteal V-Y retropositioning procedure has come under slightly more fire than the von Langenbeck operation. At the Cleft Palate Symposium in Chicago in 1977, Desmond A. Kernahan, a Kilner disciple and now chief of plastic surgery at Children’s Memorial Hospital, Chicago, argued that there is no convincing confirmation of a difference in maxillary development following the von Langenbeck and the Kilner-Wardill V-Y pushbacks. He stated frankly that the only differences were better exposure with the V-Y as the flaps are elevated and facilitation of the dissections by easier access under direct vision.

DEMJEN

Gentle Stefan Demjen of Comenius University, Bratislava, Czechoslovakia, came to England in 1948 to study with Gillies. He and I became friends and spent many a Saturday at Lord Mayor Treloar Hospital, Alton, watching Kilner and Peet adroitly execute their V-Y palate operation. Demjen was an experienced general surgeon with dexterous fingers that enabled him to pick up plastic surgery techniques quickly. During his sojourn at Iowa University before his final return to Bratislava, he developed his modification of the W-V-Y palate retrodisplacement operation and wrote a learned thesis in its defense. The Bratislava Project thoroughly evaluates the method.

Demjen noted that Kilner, Peet, Reidy and Osborne did not divide the posterior neurovascular bundles, and consequently their pushbacks were limited. He wrote:

In 1951, I decided to produce maximum possible elongation of the soft palate by severing the neurovascular bundles . . . Professor Burian and I made a sort of agreement. He in Prague would preserve the bundles and I in Bratislava would cut them, and after 5 to 10 years we would compare results.

Demjen quoted Arthur Barsky’s 1964 book:
While V to Y and pushback procedures are capable of achieving a limited amount of backward displacement, there are two deterrents that prevent the surgeon from obtaining the optimum amount of retrodisplacement: (1) the neurovascular bundle which cannot be mobilized as freely as is desirable; and (2) secondary contracture of any raw surface left on the nasal side. If one could sever the neurovascular bundle, the first difficulty might be solved, but possible complications are so obvious that this step should not be considered (Broadbent and Hochstrasser, 1959).

Demjen then noted:

At the time of reading this statement from a very experienced plastic surgeon, I had already cut the neurovascular bundles for this purpose more than one thousand times without complication in healing, growth or function of the palate.

He defended his stand with anatomical facts:

The anastomoses of the vessels in the nasal cavity and in the soft palate suffice to supply the palate after ligation of the greater palatine artery. This is certainly true in the Wardill-Kilner type of palatoplasty where the oral mucoperiosteum is divided by the oblique incision into two equally large flaps. The anterior flaps retain their blood supply from the nasopalatine arteries and short posterior flaps survive the sectioning of the posterior neurovascular bundles without trace of ill effect from diminished blood supply.

In the descriptions of his V-Y operation, the use of three flaps for incomplete clefts and four flaps for more extensive clefts and the division of the vessels were in line with Wardill’s operation. His lateral dissections were similar to those of Kilner and Peet.
His description of this mobilization of the soft palate, accompanied by drawings, was excellent:

This is done by entering the lateral pharyngeal space (Ernst's space) and detaching the entire soft palate from the attachments to the maxillary tuberosity and medial pterygoid plate. . . . After fracture of the pterygoid hamulus medially and detachment of the superior constrictor from the medial pterygoid plate, the soft palate, along with the tensor palati, the superior constrictor and the mucosa of the lateral pharyngeal wall, can be pushed medially to allow suture of the cleft margins without undue tension. The depth to which the plane between the medial pterygoid muscle and tensor palati muscle is entered must not be too high, because it is in that plane where the nerve of the tensor palati may suffer damage if it is forcibly or too highly entered or packed. (Many years ago, we completely abandoned packing of the lateral pharyngeal spaces.) Twenty-four hours after surgery one does not see any more gap in the tissues in this region. The space is most likely filled in by the tissues of the cheeks.

Closure of the nasal mucosa, if the cleft is not too wide, can be achieved by side-to-side suture, or, if available, the vomerine mucosa can be split and turned laterally to assist in suturing.

B U R I A N

In his Plastic Surgery Atlas (Vol. 2), published in English in 1968, Burian presented his rendition of the Veau-Kilner-Wardill four-flap procedure, preserving the vessels, in complete unilateral clefts.

This is his rendition of the same principle for complete bilateral clefts:
Robert McCormack of Strong Memorial Hospital, University of Rochester, New York, was a halfback and safety at Swarthmore College and was one of 20 football players of the 1939 season who later made significant contributions in their careers to be honored by *Sports Illustrated* with the Silver Anniversary Football All-American Award. Trained by Forrest Young at Rochester, he worked with him on the paper entitled "Arterial Flap Repair in Cleft Palate" which was presented to the American Association of Plastic Surgeons in Ann Arbor in 1949. McCormack describes this modification of the V-Y which he has continued to use:

The major points were the extensive incisions from the retromolar fossa laterally continuing just medial to the alveolus and completely around the anterior end of the long arterial flap, then posteriorly along the edge of the cleft. The design of the flap violated the safe dimensions of a random flap so the major palatine vessels were left intact by careful dissections of the vascular "stalk" and teasing the vascular pedicle from its foramen. After this extensive mobilization of the arterial flaps closure without tension was possible with fine suture material and eversion of the pared edges.

The anterior ends of the repaired arterial flaps were secured by horizontal mattress sutures to a small triangle of mucoperiosteum left at the extreme anterior portion of the hard palate.

This type of cleft palate repair has been continued at the University of Rochester for thirty years. Analysis of results have included speech assessment, bony growth, orthodontic cephalometric follow up and the criteria for any secondary pharyngeal flap surgery. The speech analysis has shown highly satisfactory results in over 80% of the cases.
RUSSIAN V-Y'S

In 1970 A. A. Kolesov gave us a glimpse of Russian repositioning of the palate. First he presented the radical V-Y pushback of Limberg’s method, after Rudko. Then he presented variations of the V-Y retropositioning in complete unilateral clefts (Zausayev’s method).

This is the two-staged design of V-Y procedures for complete bilateral clefts, after A. Khetrov:
All previous V-Y procedures had used mucoperiosteal flaps dissected from the bone of the hard palate to feed into the lengthening of the oral side of the palate. Herfert’s rumblings, ignored by the majority, were heard and heeded by a German surgeon, Widmaier, in Stuttgart-Süd.

**Widmaier**

At the age of 20 in 1943, Werner Widmaier of Stuttgart was wounded in the face and jaw in Russia. Treated first in Russia, he was then transferred to a hospital in Tübingen, where Eduard Schmid took over his reconstruction. During his long stay in the hospital he started his medical studies and on vacation assisted Schmid in surgery. As he told me in 1971:

My interest in plastic surgery was a result of my own wounds and living together with many whose faces had been disfigured in the war. It was the possibility of giving back a face to these people that fascinated me. To Schmid, of course, and also to Professor Trauner, with whom I worked a long time, I owe very much. Cleft surgery has always been my favorite field of plastic surgery and still is.

In 1961 Widmaier designed a palate operation which reflected the Schweckendiek influence, avoiding any disturbance of the hard palate and thus any danger of subsequent maxillary deformity, but employing the V-Y principle to provide a soft palate of adequate length and functional competence.

**V-Y Lengthening in Soft Palate Cleft**

In soft palate clefts, oblique incisions are made at the junction of the hard and soft palate, care being taken to avoid damage to the vessels and nerves. These incisions are released laterally with sharp-angled incisions, which with blunt dissection allow the posterior edges of the soft palate halves to touch the posterior wall of the pharynx. The nasal mucosal layer of the soft palate is elongated by means of the zigzag incisions of Schuchardt. The lateral relaxation defects are closed with the Blair-Schmid transposition flaps from the adjacent cheeks.
Widmaier adopted the Campbell incision for hard palate closure. A long, triangular vomerine flap is detached in the roof of the pharynx and, with its base maintained along the edge of the vomer, is peeled off the bone to span the cleft. A cuff of oral mucosa is turned over in continuity with the nasal mucoperiosteum bordering the cleft to form a lining flap. These flaps are overlapped to achieve a two-layer closure of the hard palate without maxillary disturbance.

At the same operation the V-Y posterior advancement of the soft palate is carried out, and the lateral defects are closed with cheek flaps. The nasal side of the soft palate cleft is lengthened by the zigzag interdigitations.

PERKO

In the 1974 Journal of Maxillofacial Surgery Yugoslavian Milivoj A. Perko of the University of Zurich presented an
operation for isolated cleft palate which he described as basically derived from the Widmaier method. It was indeed another and possibly an even more heroic attempt to prevent maxillary growth impairment by palatal mucous membrane dissection leaving the hard palate mucoperiosteum intact and the neurovascular bundles still attached to the hard palate. In principle, it was a primary palate closure utilizing the freed nasal mucosa as one layer, with a small Z-plasty on its distal portion, correct positioning and uniting of the levator muscle sling, and a V-Y mucosal flap advancement on the oral side.

Theoretically, this plan has many good points. Perko lists them as: (1) intact periosteum with entire coverage of the hard palate bone, (2) greater lengthening without restraining neurovascular bundles, and (3) improvement in muscle position. He also outlined the possible disadvantages:

1. Mobilization of the mucous membrane on the palate is a more difficult technique.
2. The danger of necrosis of the mucosal flap is greater, but should not occur with careful dissection of the mucous membrane. If necrosis should still occur, however, the classical closure with the palatal periosteal flap is always still possible.

Practically, it would seem that the disadvantages would eventually outweigh the advantages. Perko acknowledges only two years' experience with 35 cases, but if after two years he is still happy, then probably so are the maxillae. It is hoped that the distal ends of these mucosal flaps sympathize with the hard palate's getting all their blood supply; otherwise they may simply necrose.

In 1977 Perko explained:

Actually, we perform the mucosal flap only in incomplete clefts or isolated clefts of the palate. In the total cleft we prefer to perform the soft palate closure first and the flap reaches to the first deciduous molar, which means it is longer than in the original Widmaier technique. The dorsal cut of the hard palate becomes closed in this first operation. The hard palate is closed later, in unilateral clefts at the age of 5 to 6 years and in bilateral clefts even later.
A WARNING

As many of the surgeons using lateral relaxing incisions—including those doing V-Y pushback procedures—advocated deep and thorough dissection into the space of Ernst for medial displacement of tissue from the pterygoid plates, a warning is in order.

Ivor W. Broomhead’s 1951 work at Cambridge on the nerve supply of the muscles of the soft palate, published in the *British Journal of Plastic Surgery*, gave some important information about the dangers of injury during surgery:

In the plastic repair of a total cleft palate an incision is carried forwards from in front of the palato-glossal arch to the back of the alveolus, and then along the palatal edge of the gum to curve medially to the cleft margin. A second incision extends along the free margin of the cleft to meet the first incision anteriorly. Blunt dissection is performed down to the pterygoid hamulus, just anterior to the palato-glossal arch, and from this point into the plane between the medial pterygoid and tensor palati muscles, these muscles being separated from each other. After fracture of the pterygoid hamulus medially, the soft palate along with the tensor palati can be pushed medially to allow suture of the cleft margins without undue tension. The depth to which the plane between the medial pterygoid and tensor palati is opened up was measured in one case of a child aged 3 and found to be 2.5 cm. from the surface of the incision. A series of measurements was made from the tip of the pterygoid hamulus to the anterior margin of the foramen ovale in skulls of different ages . . . and it will be seen that the separation of the muscles extends practically to the base of the skull.

It is in this plane that the nerve to the tensor palati is found and may suffer damage during this stage of the operation.

The next stage of raising a flap from the hard palate preserves the greater palatine nerve and artery as it is carried out subperiosteally. Following this, the palatal aponeurosis is freed from the posterior edge of the hard palate, and the bone between the greater palatine foramen and the edge of the bony palate is removed to allow greater mobility of the neuro-vascular bundle to the palatal flap. Both these stages must result in damage to the lesser palatine nerves and artery. Section of the lesser palatine nerves would produce some anaesthesia of the soft palate and, if the musculus uvulae is supplied by these nerves as appears to be the case, paralysis of this muscle. The nerves also send branches to the mucous glands of the palate . . . It has been shown that at least half the substance of the soft palate is composed
of mucous glands. Any reduction of this tissue, possibly by atrophy of the glands following denervation, would result in a substantial diminution in the thickness of the soft palate and in the size of the uvula. This may have some detrimental effect on the efficiency of closure of the nasopharyngeal isthmus and on speech. . . . At no time during the operation are the nerves to the levator palati, palato-glossus, and palato-pharyngeus likely to suffer damage, as the courses pursued by these nerves are well removed from the operative field. The final stage of inserting a pack between the medial pterygoid and tensor palati muscles could again lead to damage to the nerve supply of the tensor palati.

LIMITED USE

The V-Y principle is still popular. Yet as an early primary procedure, although it provides excellent surgical exposure, it requires too much mucoperiosteal elevation, leaves residual raw areas and achieves only modest lengthening. It also burns the bridges for possible later use of an island flap by cutting across the pedicles. For these reasons I seldom do a simple V-Y pushback any more except in a modified form, after 5 years of age in conjunction with the insertion of an island flap for nasal lining lengthening in a short but mobile palate.
Cuthbert

Unobtrusive, quiet James Cuthbert came to plastic surgery as an orthopedic registrar during World War II. He joined Gillies at Rooksdoun House, soon learned about pedicles and cut a lot of flaps for war wound defects, especially for the hand. After the war he was invited to Yugoslavia to establish a plastic surgery service there. Several days after I arrived to study with Gillies in 1948, a farewell party was given for Cuthbert, who was leaving for a new position in South Africa. Gillies, in an after-dinner speech, predicted that Cuthbert would take plastic surgery to Africa and “turn up all the giraffes’ noses.”

By 1951, James Cuthbert, then of the University of the Witwatersrand, Johannesburg, had designed a multiple transposition flaps...
of oral mucoperiosteal flaps to achieve greater posterior displacement of the palate, minimize the risk of fistulae and avoid a straight-line contracture along a two-layer closure. He designed the main flap A which, when cut and peeled back, exposed the posterior palatine vessels; these were then ligated and divided. A shorter flap C was dissected and elevated, and the vessels were divided. Flap B was left, based anteriorly, and it too was elevated on the vessels coming through the incisive foramen. The nasal mucosa was mobilized and divided transversely to allow posterior displacement of the soft palate. Flap C moved back with the soft palate, flap A was transposed at a 90-degree angle and flap B slid toward the midline to close any anterior hard palate cleft.

When the cleft extended through the alveolus, an anterior first-stage, Veau-type closure was achieved and the transposed retropositioning carried out a few months later.

The lining layer on the nasal side was closed as well as possible. Cuthbert rationalized:

If the transverse relaxing incisions leave a midline deficiency, this is of no importance as long as it is placed to lie under the primary transposed flap A which will prevent fistula formation.

Gillies was intrigued when Cuthbert’s method came out in the *British Journal of Plastic Surgery*. By now I had returned to England to write the book with Gillies and remember how impressed I was with Sir Harold’s open-mindedness. He was always willing to try a reasonable design even by one of his previous students. He used the multiple transposition flaps on a few palates but without dramatic results. We were all disturbed by the large raw nasal area.

The last time I saw Cuthbert was during the 1959 International Congress in London. He, Barbara and I had been invited to a delightful cold buffet by Lady Sam at the Gillies’ flat on Queen Anne Street. After a few drinks and some fresh salmon from Scotland, Sir Harold and Cuthbert had great fun pantomiming the casting, hooking and reeling in of the great fish from the waters of the South African shoreline. Five years later, after a lengthy illness with severe residual pain, Cuthbert ended his life.
Thomas Gibson of Canniesburn Hospital, Glasgow, Scotland, had made several basic contributions to plastic surgery including the important treatise on the characteristics of cartilage. Then in 1959, 10 years before he became the respected editor of the *British Journal of Plastic Surgery*, he described a triangular flap for lengthening the short secondary palate which was similar to the Cuthbert principle. He reported no contracture of this flap with the nasal side raw, but combined the procedure with a Hynes pharyngoplasty.

He summarized that it was simple, was completed in one stage with a posterior displacement of 1.5 to 3.0 cm. and had no tendency to contract; any anterior holes could be closed with an obturator. In 1967 Hynes, after Gibson admitted using his pharyngoplasty, endorsed the Cuthbert-Gibson transposition flap for lengthening.

In 1976 Gibson wrote:

The transposition flap for lengthening the palate is an excellent operation with only one drawback. It is not always easy to avoid fistulas in the hard palate, particularly when the bony cleft is inadvertently exposed.
G E O R G E Morris Dorrance of the University of Pennsylvania was a wealthy general surgeon who had inherited the Campbell Soup Company and became director of the Atlantic City branch of the Philadelphia and Reading Railroad. Among his hobbies was the improvement of the quality of tomatoes grown in New Jersey farmlands which supplied the soup canneries of his Camden plant. Once the Campbell Soup Company was sued by a woman who claimed to have opened a can of soup and found a bandaged amputated human finger. Dorrance's investigations revealed that no one in the company was missing a finger, and the suit was dismissed.

Dorrance, who did a lot of head and neck surgery, became interested in plastic surgery, particularly mandibular fractures and cleft palate. In fact, cleft palate became his surgical hobby. In April 1925, at the meeting of the Philadelphia Academy of Surgery, he outlined his "push-back operation" through a horseshoe-shaped incision for palatal lengthening, yet without entitling it "push-back":

The rationale is to displace the velum back to enable it to assist the superior constrictor muscle of the pharynx to close the nasopharynx during speech.

He justified his approach as compared to Veau's procedure thus:

Veau succeeds in getting satisfactory functional speech in his patients with cleft palate in the average case, without backward displacement of the palate. This, unquestionably, justifies his operation, except in cases in which there is a very marked shortening. Here, we must remember that Veau operates in France, and the majority of his patients speak French. The French language,
unlike the English, calls for more nasalizing sounds, and hence complete velopharyngeal closure is not always necessary. The functional results obtained by Veau are remarkable for individuals who speak French. However, turning to our patients who speak English and to individuals who talk German and Dutch, we find it imperative to perform a "push-back operation" in persons with cleft palate in whom the velum is usually short.

In 1933 in his exhaustive book, *The Operative Story of Cleft Palate*, certainly the palate classic of its time, Dorrance concluded:

From the patient's standpoint, any operation on the palate is judged by the speech result. The secret of obtaining good speech, in cleft palate patients, is to establish complete velopharyngeal closure. This can only be established by an operation which will lengthen the velum sufficiently to meet the pharyngeal wall and to permit the "palatopharyngeal-sphincter" to shut off the nasopharynx.

He was convinced that

Nearly all cleft palate patients have a short palate. . . . It is always necessary to displace the palate sufficiently backward to permit the "palatopharyngeal-sphincter" to function properly. . . . [Thus,] we have developed the "push-back operation."

Dorrance set the operation at 5 years of age because of less mortality and less chance of failure. In his first stage, he used the horseshoe-shaped incision with elevation of the mucoperiosteum from the bone back to the attachment of the palatal aponeurosis.
The posterior palatine arteries were divided, and the flap was replaced and sutured. If there was an inadequate blood supply to the palate, Dorrance left an anterior attachment over the incisive foramen as a precautionary delaying measure and dissected the mucoperiosteal flaps and divided the vascular bundles from the sides.

Three months later, in the second stage, the lateral incisions were extended backward around the maxillary tuberosity and over the pterygomandibular fold to obtain sufficient mesial displacement of the muscular tissue. The mucoperiosteal flap was reelevated down to where the nasal mucosa could be divided from its attachment to the posterior edge of the hard palate in a true pushback maneuver. The hamular processes were divided with a chisel, for Dorrance noted that the anatomical investigations of Wardill and Whillis were similar to his own. He too felt that

It is this palatal insertion of the superior constrictor muscle of the pharynx which completes the pharyngeal ring.

A. Division of the hamulus on one side removes tension of tensor palati muscle in a case of cleft velum.

B. Division of hamulus on both sides removes tension of tensor palati muscles in a case with split velum and places palatal insertion of superior constrictor muscle in desired position to close nasopharynx.

On this basis Dorrance defended his sectioning of the hamulus, suggesting that it helped to restore the palatopharyngeal sphincter. Even after complete freeing of the mucoperiosteum from the bone, he pointed out, the tensor palati muscles hooking
around the hamular processes prevent palate retropositioning. Correction is achieved by sectioning and mesial displacement of the hamular processes, which then lengthens and converts the tensor muscle into a synergist with the levator palati muscle. He also noted:

This also displaces inward and backward that portion of the pterygopharyngeus which inserts into the hamulus thereby reducing the abnormally increased diameter of the nasopharynx which occurs in cleft palate.

Dorrance felt too that division of vessels was important and as late as 1946 insisted:

It is next to impossible to obtain the necessary length of the palate without cutting the posterior palatine vessels.

He believed that all these maneuvers achieved an effective posterior retropositioning of the palate. The edges of the cleft were then denuded, the intramuscular wire suture of Veau was
inserted with a Reverdin needle and the cleft was closed with a layer of sutures in the nasal mucosa and another in the oral mucosa.

Dorrance advocated use of his pushback in congenitally short palates and for reclaiming failures by other methods.

He diagramed the lengthening of the congenitally short palate by a horseshoe-shaped incision, elevation of the mucoperiosteum and release from the edge of the hard palate.

The dotted line shows the previous length of the short palate, but the length gained is not assured because of the large raw area on the nasal side.
Dorrance was one of the few cleft palate giants of the 30’s and 40’s whom I did not get to know. According to McDowell, he was indeed a giant, a very large man—tall, with broad shoulders, a large head, and large hands.

He died in 1949 while I was in England with Gillies. Because of his impressive book, a cleft palate bible which he left behind and which has been vital in helping to trace the evolution of cleft craft, I have inquired about him from several people who had the privilege of knowing or working with him.

The late Robert Ivy, then in his 90’s, came to Miami twice as visiting professor, and each time we would project portraits of various plastic surgeons no longer alive and urge him to reminisce. I flashed Dorrance several times, and although Ivy always gave a fair account, he would never wax eloquent, revealing the slightest suggestion of resentment. He noted:

Dorrance was not popular among the leaders because he was aggressive. He always spent lots of money on art, had diagrams of the palate operations but never a photographic record, not a picture.

Dorrance trained Arthur Dick of Washington, D.C., and must have towered over him. Dick recalled some interesting aspects of his teacher:

George Dorrance was a big man, over 6 feet and 200 pounds. He was domineering, demanding complete loyalty from his associates. Those who worked for him for years were necessarily quiet and docile like surgeon Bransfield and artist McNett. Having had contact with some of the "needlers" of plastic surgery, I can say from first-hand experience that Dorrance was a needler, a sort of minor-league Pete Moran! He was also a good technician. In spite of his large hands, he could get into a palate and complete a pushback in 20 to 25 minutes.

In Philadelphia in 1926 an important International Dental Congress was held in the convention hall, and such famous palate surgeons as Brophy, Gilmer, Ivy and Blair were there. Dorrance presented his pushback, and Limberg from Leningrad first presented his palatal lengthening procedure. Blair had an exhibit in the hall, and a young man named Brown, who had joined him just two years before, was in charge of it.
James Barrett Brown of St. Louis was one of the important forces who created the American Midwest mecca for cleft lip and palate surgery. Cases were referred from all parts of the country, and in 1936 Brown published his modification of the Dorrance push-back. In 1940 in *Surgery, Gynecology and Obstetrics*, with lovely illustrations by G. Hance, he described various ways of gaining extra length. He preserved the posterior palatine vessels, sectioning the tensor tendon in one stage. He left a small section of mucosa at the edge of the hard palate to which to suture the tip of his mucoperiosteal advancement flap. Brown kept it optional, depending on blood loss, as to whether or not the cleft in the palate should be closed during the lengthening or at a second stage. He reported 25 excellent results out of 32 patients. A large raw area was left on the nasal side, but, with so much pushback, some lengthening was achieved. If the cleft in the soft palate had not been closed during the first operation, it was quite easy to close it in the second stage.

In 1940 Brown described a double elongation in partial cleft palate where only a narrow band of bone and soft tissue is present anteriorly. He set the palate back once and then, by splitting the palatal mucoperiosteal flap, set it back on itself in a second pushback.

This much lengthening necessitated sacrifice of the arteries. The completed "double set-back" and closure of the cleft gained in length about the distance from the hard palate edge to the incisors and without any opening into the nose. The raw surface closed over in two to four weeks.
In reference to the denuded area of the anterior hard palate, Brown reported that complete healing occurred in 20 to 30 days and was practically normal in appearance except for the absence of rugae. He acknowledged a humping from side to side of the mucoperiosteal flap at the edge of the bone where the excess was folded on itself. He considered the actual lengthening to be the difference between the tissue in the humping and the distance the edge had been set back. Brown admitted:

A possible objection to this procedure is that the resulting raw nasal surface may contract and shorten the palate secondarily, but so far we have not noted this as being important enough to try to cover the raw surfaces with skin grafts. These palates usually appear excessively long on inspection and the surface nearly always smooths out.

Brown also used this principle of splitting the mucoperiosteal flap in complete clefts of the palate after the cleft closure had been accomplished in a previous procedure. Hance's drawings show the procedure clearly.
As already mentioned, St. Louis was a great cleft center during the 1940's, and many visitors from all over the world came to watch the Big Three B's, Blair, Brown and Byars. Then as now, visitors were prone to ask some unessential questions, such as "What kind of suture are you using?" This sort of thing used to send Barrett Brown up the wall! Edgerton recalled an incident that occurred while he was assisting Brown:

Dr. Brown had carried out one of his pushback operations on an incomplete cleft of the palate. He had closed the muscle layer and the nasal mucosa, and was in the process of putting in a row of interrupted sutures along the oral mucosa. As was his custom, he would rapidly run down 8 or 10 knots with each suture, to avoid having the patient's tongue successfully untie the suture in the post-operative period. A French surgeon who had been leaning over his shoulder all morning finally asked his first penetrating question of the morning:

"Dr. Brown, how many knots do you tie on each of those sutures?"

Barrett replied without hesitation:

"Seventeen."

and from that moment, by exact count, tied 17 knots on all of the remaining sutures.

It is possible that there is a surgeon somewhere in Europe today still throwing 17 knots on every palate suture in the hope of attaining a Brown result.

Controversy is the spice of life, and there was some "spice" between Brown and Dorrance. As assistant resident on Brown's and Byars' services at Barnes Hospital in St. Louis, I once asked the chief resident if a Dorrance pushback was to be used in a certain case. The loyal resident asked:

What is a Dorrance procedure?

Naively, I rose to the bait and told him in detail with dates. It was soon after this and several similar such slipups that Brown called me to his office and requested me to complete my last three months of required residency training somewhere else. I followed his suggestion, which turned out to be such a good one that I extended it to 18 months in Detroit and Houston.
There is always more than one side to every controversy, so I asked Josh Jurkiewicz what he remembered. He is a product of the Brown, Byars and McDowell school and is a smart, gentle but honest surgeon who cuts as deep as is required. He recalled in 1976:

About all I can remember was that Brown had little use for Dorrance or the Dorrance procedure. He felt that Dorrance was given credit for the pushback operation when, in fact, he should have been, i.e., Dorrance’s two-stage preliminary ligation of the descending palatine vessels was followed by the pushback and a skin graft to the palate, whereas Brown’s procedure was a straight-forward pushback. . . . Erie Peacock might have a story or two about Brown. He worked with Brown a great deal more than I did. I had a tendency to spend all of my time with Byars. Brown knew this and it annoyed him. Consequently, I was not one of his favorites.

Then I turned to one of the famous Missouri Four—Frank McDowell, who was there through most of it. In spite of his affection for Brown, he calls it as he saw it and possibly sheds some light on Ivy’s reluctance to reminisce on Dorrance:

Blair and Brown were good friends of Dorrance and good friends of Ivy, but there were some local frictions between Dorrance and Ivy—precipitated probably by the situation whereby Ivy was Chief of Plastic Surgery in the School of Medicine of the University of Pennsylvania, whereas Dorrance could not get an appointment in that school and had to be satisfied with being Chief of Maxillo-Facial Surgery in the School of Dentistry of the University of Pennsylvania. This was particularly abrasive to him because it was Ivy who had a dental degree, not Dorrance—whose background was in general surgery and who did a lot of big head and neck cancer surgery at the American Oncologic Hospital in Philadelphia. The whole business was the height of irony. Dorrance probably could not escape the feeling that if Ivy had tried harder, he could get Dorrance a position on the medical faculty; Ivy, on the other hand, told me that he did try hard, but the general surgeons who were in control of the Department of Surgery in the medical school didn’t want Dorrance because they viewed him as a threat to some of the head and neck cancer work they wanted to do. Dorrance’s first paper on his pushback was published in 1925 in Annals of Surgery. He thought he would have to make the mucoperiosteum of the hard palate a delayed flap to keep it from sloughing, so he did a preliminary operation to raise this area and to cut both palatine arteries and tie them off. He also thought that it was difficult to raise the palatine flaps satisfactorily without tearing the
arteries, and if this was successful, the intact arteries would inhibit the retrodisplacement of the palate.

Brown devised a technique for “stretching” the arteries out of their foramina and elongating them while raising the palate, and then for cutting them loose from the palate flap for one or two cm. forward from the bony foramina—so that he had more than enough length to the arteries to set the palate back as far as it would go, with the arteries which were formerly running in an anterior direction now running in a posterior direction part of the way. He thought the advantages to this were: (1) it required one operation instead of two, and (2) if the palate were raised only once and set back at the same time, there would be less scarring in the anterior part of the soft palate than if it were raised twice.

Dorrance was at first a little resistant to this, and he had some feeling that Brown’s calling his operation an “elongation” or “setback” implied that the whole concept was a new one. However, Brown explained to him that he used the new words so that the delayed flap would continue to be known as a “pushback” and the direct flap would be known as an “elongation” or “setback.” Rather than insisting that Dorrance was wrong, he wanted to present his operation as an alternative for those who thought they had the technical skill to do it.

Dorrance came out to St. Louis and watched Barrett and watched me do this procedure several times. He came to believe in it and (about 1940) he told me at the operating table, “If I were your age and had your hands, this is the way I would do it.”

In our experience, the procedure worked much better for partially cleft palates than for complete clefts—and it worked much better when it was done at the same time the partial cleft palate was closed (preferably around the age of 18 months). When the combined procedure was done at this age, it was almost unheard of for the child to require any speech training whatsoever, or to have anything other than the spontaneous development of perfect speech. Sometimes, there was some scar pull medially on the canine or bicuspid teeth, usually resulting in the medial displacement of one or two teeth from the arch—rather than contracture of the whole arch, which also occurred on rare occasions. We did not see retrusion of the upper jaw in these patients.

In his 1958 book, Reconstructive and Reparative Surgery, Hans May had Dorrance’s great artist McNett sketch Brown’s setback modification of the pushback with preservation of the vessels and secondary cleft closure, which was an interesting switch in itself. The drawings were so superb that they have been included for extra clarity.
GRAFTING NASAL RAW AREA

Eventually the raw nasal side of the pushback began to get attention and then coverage. In 1942 Hamilton Baxter of Montreal began to apply split-skin grafts to the raw surface. In 1943 George Dorrance and John Bransfield of Philadelphia were also covering the nasal raw area in their pushback operation with skin grafts as shown!

A USEFUL PRINCIPLE

The horseshoe-shaped incision incorporates all anterior mucoperiosteum in one unit for a pushback in a most efficient manner. Of course it is only available in incomplete palate clefts or sometime after anterior closure of complete palate clefts. I favor the method quite often and, as will be described later, like to take a bipedicle island flap off the anterior portion of it to line the nasal defect of the pushback.

TOGGLE TACKING

When mucoperiosteal flaps have been elevated during palate surgery, especially in the horseshoe flap of Dorrance, the surgeon often has difficulty reattaching these flaps to the bare bone to prevent them from flopping about. This can be quite a "sticky" problem.

In 1976, in the British Journal of Plastic Surgery, Dave Furnas, with Myron Bloom of the University of California, Irvine, exer-
Clocking the ingenuity of the human fly clinging to a wall, described a clever way to fix palatal flaps to the inscrutable flat surface of the denuded hard palate. A single hole is drilled through the bone. A small rectangle of Teflon, 1.5 × 5 mm., is cut from (John Dore Co.) 0.38 mm. sheeting. A suture is passed through the flap, through the Teflon crosspiece and back through the flap. The toggle is inserted through the hole and locked, and the suture is tied. Two toggle ties are shown in the diagrams. If greater strength is needed, the toggle can be made of stainless steel or titanium. Furnas noted:

This toggle is particularly useful in cleft palate surgery; a Dorrance or Veau flap can be secured to bone as readily as a Wardill or a Langenbeck, and dead space is eliminated.

He added later:

This is a homely little contribution, but it does give the surgeon endless flexibility in cutting and positioning the palatal flaps, in that anchoring points can be completely disregarded. The Teflon toggle can secure the soft tissues to any point on the bone.
29. Methods of Handling the Neurovascular Bundles

The fixed position of the neurovascular bundles coming out of their bony foramen has always had a restraining effect against successful pushback procedures.

Blunt Freeing and Tugging

Timid and gentle surgeons have been content to tease the bundles free or pull them gently from their bony exits, achieving an apparent stretch but probably with an ineffective gain. MacCollum at Boston Children’s Hospital about 1944 used to describe this maneuver “like a robin pulling an earthworm out of its hole.” Yules used the same description 30 years later.

Osteotomy

Alexander Limberg of Leningrad evaluated the costs and, deciding that bone was more expendable than blood supply, proceeded to plan resection of the posterior wall of the foramen. In his paper “Neue Wege in der radikalen Uranoplastik” in 1927, he stated:

The artery palatine major should be freed together with the periosteum circumferentially. Then follows the “Resectio margina foraminis palatini,”—the posterior and medial edge is resected by a chisel. The neurovascular bundle can now be easily moved from the canal posteriorly and medially.
Herbert Conway of Cornell University Medical Center expressed his preference for Limberg’s osteotomy in 1947.

Since preservation of the blood supply and the innervation of the soft palate are in keeping with the principles of reconstructive surgery, the thought occurred that the freeing of the neurovascular bundle from its bony environment would overcome the objection offered to Brown’s technique for push-back operation and yet allow for the effective performance of the procedure in one stage. The osteotomy is performed with a small chisel . . . a thin plate of bone, 3 to 4 mm. in width and 1 to 1.5 cm. in vertical dimension, is removed—after the osteotomy is completed, the palate is dislocated posteriorly so that the palate touches the posterior pharyngeal wall.

In 1962 Ohmori of Tokyo noted:

Doctor Tange, one of our co-workers, devised a special chisel for the operation of cleft palate with which the bone surrounding the major palatine artery is cut off.

In 1964 R. Ruding of the Netherlands observed that during palate closure

The greater palatine artery should also be displaced backwards, especially because the greater palatine foramen is relatively forward from its normal position in the case of cleft palate. If not displaced posteriorly, the neurovascular pedicle will tend to keep the muscular mechanism forward, and this in turn will lead to reattachment of the muscle in its original position. Veau states that it is possible to pull the artery from the palatine canal but I find this quite impossible. . . . The posterior rim of the foramen is quite angular, and during a push-back of the tensor-levator system the artery will ride over the sharp edge. Because the vessel may be unnecessarily pinched or kinked as it rides over the rim, it is useful and easy simply to chisel away a portion of the back wall of the greater palatine foramen.

Although the Limberg osteotomy became popular, was used by many surgeons and is used in some clinics today, there were some surgeons who objected. Stefan Demjen, who favored dividing the vessels, argued:

I always have objected to using chisel and hammer for “retrodisplacement” of the bundles for two reasons: (1) osteotomy is a traumatizing procedure, (2) the retrodisplacement gained in this way can be effective only if it is done extensively, which is an unpredictable procedure and can do more harm than help.
DIVISION OF THE BUNDLES

The more radical surgeons actually divided the neurovascular bundles on purpose. As noted by McDowell, George Dorrance advocated cutting the major arteries; it had always been his contention that in a correctly performed von Langenbeck operation the posterior arteries were divided. He was not concerned that his procedure did the same and defended his stand in 1925:

Does not this method predispose to sloughing of the flaps? In the cases I have observed so far, I have noted less blanching of the flaps than in my usual cleft palate operations. There has been no sloughing. The blood supply comes in through the tonsillar plexus.

Yet in later papers Dorrance advocated a preliminary operation to cut and tie the arteries while raising the flap, considering it safer to delay the flap.

Other surgeons, like Axhausen, Wardill, Browne, Hynes, Cuthbert and Demjen, also were determined to sever this tether and achieve their objective at all cost. With or without a delay, they simply ligated and divided or cut and twisted the vascular bundles. The soft palate was thus definitely freed from its moorings to the hard palate and allowed to drift back toward the pharynx.

As early as 1933 Wardill wrote his thoughts on the division of the posterior palatine artery during palate surgery.

A great deal has been written about the necessity of preserving this vessel, and while I would not advocate its division as a routine procedure, on the occasion when I have done this by accident or design I have seen no ill results following. Sometimes it is essential to divide both vessels so as to bring the two halves of the palate together without tension.

A rare combination of Hughlett Morris of the University of Iowa and Stefan Demjen of Comenius University, Bratislava, in a 1978 book, The Bratislava Project, described and evaluated Demjen's modification of the W-V-Y palate pushback in which he ligates the posterior palatine vessels. Morris concluded:

The studies in the Bratislava Project which relate to general maxillofacial growth and development indicate that severance of the neurovascular bundle is not greatly detrimental to the growth and development of the midface.

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THE COST

In 1959 Broadbent and Hochstrasser studied mongrel puppies after division of the descending palatine nerves and found no gross or microscopic atrophy of mucous glands or muscle tissue and no paralysis. In two human cleft palate cases, however, they sectioned the left neurovascular bundle and found that the half of the palate on the sectioned side was 3.0 to 3.5 mm. shorter than that on the control side with a reduction in palatal bulk. Secretory activity of the mucous glands on the sectioned side many months later was approximately one-fourth that of the normal side. These findings confirmed an obvious dictum: Unnecessary division of the neurovascular bundle is contraindicated. In fact, the authors went even farther:

Section of this neurovascular pedicle is not permissible in palate repair in humans without fear of atrophic shrinkage.

DISSECTION OF THE NEUROVASCULAR BUNDLE OFF THE FLAP

As early as 1940 James Barrett Brown of St. Louis had found a way to preserve the vessels but achieve lengthening without sectioning the posterior foramen wall:

Preservation of the major palatine arteries is possible in nearly all patients, and freeing is effected by careful loosening of all tissues around the artery, gently stretching it from the foramen and, if necessary, cutting it away from the palate flap. These methods have seemed better than trying to dislodge the artery from its bony canal by trying to remove the posterior wall of the canal.

Frank McDowell, with M. Fryer and J. B. Brown, described the procedure in greater detail in 1954:

The arteries are stretched out of the bony canals and partially loosened from the palate flap, but are left intact. If there is any question as to the length of the arteries, they should be carefully freed from the palate flap for a distance of 1 to 1.5 cm. forward before the elongation is done. They must be loose enough to completely change directions and even run backward a little ways after the palate is set back.
Peter Randall recalls teaching residents to dissect the vessels off the mucoperiosteal flap in 1954 at Barnes Hospital.

SHARP DISSECTION OF VESSELS

Milton T. Edgerton, a soft-spoken Georgian with the ecclesiastical presence of a clergyman, inherited the position of chief of plastic surgery at Johns Hopkins Hospital after the death of Edward Hanrahan. In 1961 Edgerton first gave his old teacher credit for the general idea of freeing the neurovascular bundles:

J. B. Brown in 1936 made an important addition to the surgery of partial clefts by “mobilizing, but not cutting, the major palatine arteries from their foramina.” He was able to get the vessels in all instances to stretch or elongate sufficiently for the palate to touch the posterior pharyngeal wall at the end of the operation.

In 1962 in *Plastic and Reconstructive Surgery* Edgerton mentioned his own occasional unhappy experience with a “blunt” approach, attributing it to the limited length of the neurovascular bundles. He then reported his series of 50 cases in which he had freed the neurovascular bundles extensively by sharp dissection from the mucoperiosteal flaps. He noted interesting anatomical findings:

The three descending palatine nerves course forward closely parallel to the major palatine artery and . . . by the division of two tiny minor palatine
arteries near the greater palatine foramen, the major palatine artery and descending palatine nerves can then be dissected free from the palatal mucoperiosteal flap for a distance of some 2 cm. anteriorly without encountering other major branches. It may be seen that for every centimeter that one dissects the neurovascular bundle free from the palate flap, he gains approximately 2 cm. in posterior mobility of the palate flap... The technique is of value, both in repair of complete and partial clefts of the palate.

In 1976 Edgerton wrote me:

Sharp dissection of the neurovascular bundles may be the most important contribution that I have made to this complex subject. That simple device, for the first time, made it possible for me to place the mucoperiosteal flaps at any point I wished, in the process of retropositioning the palate.

Demjen enumerated Edgerton's 1962 reasons for preserving the major palatine arteries during lengthening procedures:

(1) The actual circulatory safety of the palatal flaps during the healing period, (2) the later bulk and secretory activity of the palatal mucous glands, (3) the actual length of the soft palate, (4) sensation and taste in the repaired palate, and (5) subsequent growth of the underlying bones

and then proceeded to attack Edgerton's claim with:

These statements are in contradiction with my personal experience and clinical observations.

**IF IN DOUBT, DON'T, OR SAVE THE VESSELS**

Although the neurovascular bundles do tend to tether the soft palate to the hard palate, there seems to be no real justification for dividing them. It is not likely that their division will be catastrophic for either blood supply or growth. Yet if they can be freed from the foramen or the flap, and if necessary the restricting posterior wall of the foramen can be removed, there is no need to divide them. It takes a little more time and skill, but these vessels can be of great value under certain circumstances. If they have been destroyed at leisure, they are alas no longer available for important duty in an emergency!
ONE century ago the American Indian was undergoing "operation pushback" on the frontier of the New World, while in Europe the palate also began to be subjected to "pushback" operations. As Newton noted, for every action there is an equal and opposite reaction: The Indians resisted the push with tomahawks and flaming arrows, while raw areas of pushed-back palates granulated and contracted.

On June 25, 1876, Chief Crazy Horse and his bands of Sioux and Cheyenne warriors wiped out General Custer and his men at the bloody battle of Little Big Horn. Meanwhile, in Paris from 1876 to 1878, Passavant, experimenting with various pushback palate procedures, became discouraged by contracture as did others who followed him. Not until over half a century later and many a "last stand" in palate pushback did surgeons begin to develop a defense against the "Little Big" nasal raw area.

As surgeons became more dedicated to lengthening the soft palate toward the posterior pharyngeal wall, the number of pushback procedures increased. Surgeons like Dorrance, Brown, McDowell and Byars were radical enough and divided the nasal mucosa from the posterior edge of the hard palate, increasing the immediate effective pushback lengthening. This left the nasal side raw for the exact amount of pushback, and gradually the length obtained at operation diminished.

In 1952 Wallace Steffensen reviewed the palatal lengthening operations and expressed a feeling that more accurate records of
end results of various methods of lengthening should be kept for future evaluation.

Randell Champion of Manchester, England, noted in 1957:

In the standard V-Y closure of a cleft palate the palatal mucous membrane of the soft palate is lengthened by reflecting the mucous membrane from the hard palate and then suturing the hard palate mucous membrane in a more posterior position, incorporating some of it in the soft palate. The nasal mucous membrane is reflected from the medial and posterior edge of the hard palate but is not lengthened or transposed backwards. Thus with healing the palate mucous membrane tends to return to its original position because there is no corresponding lengthening of the nasal membrane to maintain the lengthened velum.

In 1960 James Calnan of London observed that after certain V-Y retropositioning operations there was failure to obtain the expected length. He offered the presence of midline fistulae at the posterior border of the hard palate as evidence of breakdown and fibrosis with contracture of the soft palate. Even in the absence of a fistula, he presumed a hidden breakdown and scarring of the nasal mucosa with resultant contracture. Thus, as the evidence mounted, more surgeons were stimulated toward more sophisticated efforts of coverage of this nasal area.

Z-PLASTY

A standard lengthening procedure, of course, is the Z-plasty, and some surgeons have advocated this principle for lengthening the nasal lining. In 1957 Champion wrote in the British Journal of Plastic Surgery:

The nasal membrane may be lengthened by undertaking a Z-plasty of the nasal mucous membrane. This small plastic manoeuvre is of utmost importance in the primary repair of a cleft palate and may make the difference between normal and imperfect speech. The Z-plasty also tends to reduce the palatopharyngeal opening. In a small percentage of primary repairs it is not possible to perform the Z-plasty, particularly in clefts involving most of the hard palate. In secondary repair of palate the creation of a large Z-plasty or two smaller Z-plasties may materially influence the final result.

In 1962 in Plastic and Reconstructive Surgery Edgerton advocated palatal lengthening with sharp dissection of the neurovas-
cular bundles. This resulted in a shortness in the nasal mucosal lining. He chose the Z-plasty principle for lengthening the nasal mucosa.

As the presence of a cleft in the palate usually indicates lack of tissue in the transverse dimension, it is a contradiction in logic to expect to get anterior-posterior lengthening with a Z at the expense of side-to-side tightening.

**SPLIT-SKIN GRAFT**

*Hamilton Baxter*

Hamilton Baxter, a Canadian surgeon in Montreal, had also become pessimistic about the fate of the nasal raw area after palate pushback. He had the plastic sophistication to extend the principle of “cover to all raw area” to the superior, “out of sight” surface of the palate. In 1942 in the *Canadian Medical Association Journal* “Happy” Baxter proclaimed the not-so-happy fact that the von Langenbeck procedure not infrequently failed to achieve normal speech and gave his explanation:

This is due to the anterior pull of the contracting scar tissue on the nasal side of the mucoperiosteal flaps so that the velum cannot be brought into contact with the velopharyngeal wall, and speech assumes “cleft palate” characteristics.

In the severely shortened palate, where all the length achieved by a pushback was essential for good speech, Baxter devised a method, in 1942, which he said would
avoid the thickening and shortening which an unlined flap with its raw surface exposed will always undergo, irrespective of its situation in the body.

Inspired by Gillies’ application of Esser’s principle of a skin graft on a stent to the raw bony surface in the Gillies-Fry pushback, Baxter made two lateral incisions in the mucoperiosteum a few millimeters from the teeth, extending from the tuberosity of the maxillae forward to the canines. The posterior palatine vessels were divided, and the mucoperiosteum between these incisions was elevated. For this tunnel a piece of red wax was fitted, covered with a thick split-skin graft from the hairless buttocks and then inserted as an inlay. The incisions were sutured and left for one month. Finally, the stent was removed and the anterior release completed with a Dorrance incision, allowing a radical pushback of the palate. The nasal surface of the mucoperiosteum, having been lined with skin, was expected to show little or no tendency to contract and foreshorten the elongated palate.

Five years later in 1947, and four years after Dorrance and Bransfield published their method of applying skin grafts to line the raw nasal surface of mucoperiosteal flaps for pushback in seven types of palate defects, Hamilton Baxter and Mary Cardoso of McGill University and Children’s Memorial Hospital, Montreal, noted:

Since many surgeons working independently have sometimes reported new methods co-incidentally, no one man can lay complete claim to an operative procedure, since tribute must be paid to the experiences of preceding and contemporary surgeons whose efforts have provided the foundation on which some technical refinement is based.
They then reendorsed their skin graft method in *Plastic and Reconstructive Surgery* and used these diagrams to show bilateral skin grafts for lining the future nasal surface after pushback in clefts extending through the hard palate, similar to that described by Dorrance and Bransfield in 1943.

Subsequently the lined flaps were elevated, the cleft was closed and the palate was pushed back. When the palate was short and contracted after primary closure, the mucoperiosteum was elevated by splitting it to avoid opening the cleft. A stent wrapped with a skin graft was buried under the flap, and later a pushback of the lined flap left a skin graft also covering the bone.

They reported speech results better than those following the ordinary operative procedures. They also noted:

In all cases examined by nasopharyngoscope, the graft was found to be viable and with no evidence of crusting or offensive odor. Grafts over a year old had developed a pinkish color and one graft which was five years old had evidently undergone considerable metaplasia, for only a faint whitish tinge differentiated the graft from the surrounding mucosa.

**Dorrance also using skin grafts**

Obviously, Dorrance too had become concerned about the raw area on the nasal side of the lengthened portion of his palates. In 1943, with John Bransfield, he described a modification of his two-stage pushback which applied skin grafts to this area. They designed its use in seven types of cleft defects and published their work in the *Annals of Surgery*. In the first stage the mucoperios-
teal flap was elevated, a split-skin graft applied to the undersurface and the lined flap replaced in its original position. In the second stage the "push-back" procedure was carried out as previ-ousl

ously described, but the sliding portion of the mucoperiosteal flap now was lined with skin grafts, which ensured maintenance of the acquired length by reducing contracture. The cleft in the velum was closed at this time.

In 1955 R. Ruding of Amsterdam presented his release of the nasal mucosa and closure with a Thiersch split-skin graft. In 1977 he wrote:

Later on, I saw that the skin transplantation was not necessary and abandoned it for muscle correction, described in 1964.
Brown holds his nose

Barrett Brown’s eventual response to this nasal skin graft was not without a nasal grimace. He explained that skin grafts on the nasal surface of the palate pool mucous discharge, resulting in desquamation of epithelium and producing a *foul odor*. As he gladly applied split skin by the yard almost everywhere else on the body, it is noteworthy that he was adamantly against it for surfacing the nasal raw area in palate pushback procedures. Thus any popularity enjoyed by this approach was soon snuffed out.

FREE GRAFTS OF MUCOSA

In 1949 Richard C. Webster of Brookline, Massachusetts, commented that skin grafts in palatal lengthening were becoming more and more popular in spite of the reports of contracture and crust formation. He also said:

In addition, there is the possibility that hair will grow on a certain number of these grafts; and hair on the nasal side of the soft palate would be disagreeable, to say the least.

Webster reported his use of free mucosal grafts to line the nasal side of the pushback:

Following a discussion with Dr. Bradford Cannon, the reviewer [Webster] has used mucous membrane grafts applied to the nasal side of the mucoperiosteal flaps. The mucous membrane grafts were taken from the buccal mucosa and applied in the first stage of a two-stage “push-back” procedure. In the second stage, the flaps were elevated and the palatal tissues retrodisplaced. There has been no evidence of crust formation where these free transplants of buccal mucosa were made.

Victor Spina, with Lodovici, Pigossi and Faiwichow of São Paulo, Brazil, in 1961 in *Revista Latino-Americana de Cirurgia Plástica*, suggested a one-stage pushback procedure using a free graft of buccal mucosa—Cardoso’s method—to cover the open wound on the nasal area of the elongation. Yet the difficulty of obtaining such a graft, the irregularities of the base, the inaccessibility of the area for dressings and the hazards of an unseen “take” and survival have been responsible for little acceptance of this approach.
SLIDING NASAL MUCOSA

Thomas D. Cronin of Baylor University College of Medicine, Houston, is quiet, mild and most unlike a textbook Texan. In 1971 he reaffirmed Dorrance’s 1933 and 1943 dogmatic declarations:

Most cleft palates are also short palates, and repair of the cleft alone is likely to leave the patient with an incompetent velopharyngeal mechanism. Retrodisplacement of the soft palate is one of the more obvious remedies, but to achieve this posterior movement it is necessary to sever the nasal mucosa from the bony palate. When the velum is shifted back, however, a raw area is left on the nasal side of the mucoperiosteal flaps. While an effective lengthening can be obtained at the operating table, the scar contracture of the healing raw area on the nasal surface pulls the velum back almost to its original position.

In 1957 Cronin proposed posterior advancement of mucosal flaps from the nasal floor to shift the raw area to a bony surface and reduce the soft tissue contracture. Fourteen years later, he stated:

This operation is recommended as the primary repair in all infants and young children. It may also be used in young children who have a short palate following a simple closure of the cleft. In older children and adults the procedure usually should be combined with a pharyngeal flap or nasopharyngeal implant.

Cronin cautioned:

In order to minimize the adverse effects of scar contracture secondary to elevation of mucoperiosteal flaps on bone growth, the pushback procedure should not be performed before 2 years of age in unilateral clefts of the primary and secondary palates, or in clefts limited to the secondary palate. Repair of complete bilateral clefts should be delayed until the age of 2½ years.

Operative details

The Ganzer-type mucoperiosteal flaps are elevated and Limberg’s ostectomy is used to free the neurovascular bundles. Then Cronin gets out his bag of new short irons. First, his right-angle knife is inserted through each nostril and passed backward until seen at the posterior edge of the hard palate in the cleft. The instrument

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is then withdrawn 1.5 cm., and the blade is moved transversely from side to side several times across the rather irregular floor of the nose. Then the Freer knife is passed through the nostrils and is used to cut the mucosa on the lateral and medial boundaries of the nasal floor.

In incomplete clefts, this action is entirely blind; in complete clefts where access is possible a right-angle scissor may help in the transverse cut of the nasal mucosa.

Now, and not until now, the aponeurosis is detached from the posterior border of the bony palate with a Freer septal elevator, being careful not to tear the thin nasal mucosa.

Further nasal mucosal freeing and release will eventually allow the palate to move backward, dragging its thin mucosal flaps with
it like a bridal train. Hamular fracture is used when indicated. Suture of all flaps to one another and apposition of the oral mucoperiosteal flaps with iodoform packing under guy wires passed through the gums complete the operative procedure.

This was Cronin’s 1957 design for closing and retropositioning the soft palate at one operation in a narrow single cleft. (A) The broken lines showed the mucosal sulcus flap, an anterior triangular mucoperiosteal flap and two remaining asymmetrical mucoperiosteal flaps. The dotted line marked the division of the soft palate attachments to the hard palate. (B) The vomer flap was turned under the anterior triangular flap and the mucosal flap from the sulcus gave oral closure in the alveolar area. (C) The nasal mucosa had been shifted to cover the advancing mucoperiosteal flaps. (D) The longer mucoperiosteal flap was shifted toward the cleft side to avoid two superimposed suture lines.
Pre-pushback marking

The posterior bony edge of the hard palate and the point in the nasal mucosa detached from this edge are marked with 28-gauge wire knots to measure the actual lengthening achieved at one week and at two months after pushback. A single lateral x-ray view was taken with the central rays directed 1 inch anterior to and 1 inch below the external auditory meatus.

Postoperative measurements

In 1965 Ray Brauer, Cronin's Texas "pardner" for over 20 years, reported on the x-ray examination of 85 patients, 10 of whom had lost their wires before completion of the study. Of the 75 remaining patients, 46 percent revealed a contracture of 1 mm. or less and 37 percent a contracture of 2 to 3 mm. Seventeen percent showed 4 mm. or more of contracture, and of these cases six were posterior clefts (blindest type)—three horseshoe clefts and three wide clefts through half the hard palate. As pointed out by Brauer:

The extremely wide clefts, especially the posterior and the horse-shoe type, coupled with inadequate nasal flaps, are the major factors resulting in excessive contracture.

Here is Cronin's diagramatic sketch published in Plastic and Reconstructive Surgery in 1957, displaying the complex shifting of nasal mucosa in a wide, horseshoe-shaped defect. A flaps swing in together, B flaps swing back, leaving an area (C) still raw on the nasal side.

However, it was possible to claim

an overall average for all cases of 12 mm. with a contraction average of 2 mm. or an overall gain of 10 mm.

This approach has its ardent followers because it is logical and reasonably sound in principle. For instance, in 1970 Manchester described his modification of the Cronin nasal advancement principle along with a V-Y retropositioning of the oral mucoperiosteum in his second stage of complete bilateral clefts.
Yet it is technically difficult, because it calls upon *blind* and *bloody* dissection of *thin* mucosa, requiring a whole new bag of clubs. Its only physiological "drawback" is the denudation of *both* sides of the bony palate.

When needled about such plastic acrobatics, Cronin responded:

All of the residents and preceptees in our plastic surgery training program in Houston have learned to raise the nasal flaps successfully.

Whereupon Herb Conway, with typical Irish wit, retaliated:

But I would have to go back through a residency, and even then I doubt if I could ever do it!

Moore and Chong of East Grinstead, England, stated in 1967:

Cronin (1957) advocated the use of flaps of mucosa from the floor of the nose to cover the raw areas of the lengthened soft palate, the flaps being raised by a special knife introduced through each nostril. The technique, though in theory sound, was in practice difficult and did not gain universal approval.

**NASAL MUCOSA TRANSPOSITION**

David B. Stark of the State University of New York, Syracuse, in 1963 described a variation in the use of nasal mucosa. Accompanying the standard Wardill-Kilner V-Y oral flap design, he utilized the nasal mucosa to achieve lengthening with closure in a staggered line. He freed the nasal mucosa of one palate shelf, and with its base posterolateral transposed it into the usual transverse releasing incision in the nasal mucosa, along the posterior edge of the hard palate. This is the nasal rendition of the transposition lengthening that Cuthbert described in oral mucoperiosteal lengthening.

In 1976 Stark confirmed his continued use of the nasal flap:

It is the simplest, of course, to do in the partial cleft where the procedure is really a proper Z-plasty.

In the complete cleft, I do the anterior palate defect repair with a vomer flap and a labial flap between the alveolar ridge defect to prevent a pre-alveolar fistula. The second stage repair done about two months later will be
determined by the position of fixation of the vomer to the uncipt side palatal shelf. Frequently the repair will be anteriorly with a vomer flap brought across and posteriorly with the nasal lining flap based on the posterolateral area of the cleft side. In most instances this allows for complete closure of the nasal surface and for as much retrodisplacement as you wish.

Actually, my problem has been a deficient length of oral mucoperiosteum if the setback is allowed to be as great as can be produced by the nasal lining. In other words, the restriction of retrodisplacement is due more to lack of length of the Wardill type of oral mucoperiosteal flaps than to a problem of getting coverage on the nasal surface of the lining flap.

This method seems to suffer some of the problems of the Cronin approach. It requires blind dissection and may offer limited lengthening, but it certainly denudes both sides of the hard palate of its covering mucosa and mucoperiosteum.

A TURNOVER FLAP FOR HARD PALATE NOTCHES

A mucoperiosteal flap based posteriorly on the edge of the cleft to be turned backward to present mucosa for the nasal lining in the cleft is based on the Krimer principle and was used on a large scale by Bonfils in 1830. Over 130 years later, Edgerton reduced this same flap to fill notches in the hard palate only, as shown in his illustrator’s drawings presented in Plastic and Reconstructive Surgery, 1962.

The concept appealed to me, but in actual practice, in my experience, the flap has a poor blood supply and does not remain
viable. It is interesting that the drawings for Edgerton, by their realistic shading, forecast doom for this little flap by leaving it white, just as I have seen it at the end of an operation. The point being made here is: Beware of flaps on the palate meridian, particularly at the attenuated edge of the cleft.

VOMER FLAPS

Charles Horton of Norfolk is extremely adept at many things, and one of them is maneuvering mucosa into areas of need. In 1973 in *Plastic and Reconstructive Surgery*, with T. Irish, J. Adamson and R. Mladick, he described the use of vomerine mucoperiosteum to be turned as two long narrow flaps based posteriorly and sutured into the transverse nasal mucosal defect created by the division of the soft from the hard palate in a pushback.
Horton wrote to me in 1976:

I have used this approach several times over the past few years but it requires a particular kind of case with a large vomer and one in which vomerine tissue is not needed elsewhere.

In the 1978 *Cleft Palate Journal* Harold D. Clavin and John Q. Owsley, Jr., of the University of California, San Francisco, presented a posteriorly based vomer mucoperiosteal flap (B) on the cleft side and a nasal floor mucoperiosteal flap (D) (Cronin) on the non-cleft side to supply nasal lining during palatal pushback in unilateral clefts. This combination seems to have some promise. Of course, the disadvantage is the same as with all methods elevating large areas of mucoperiosteum and leaving raw areas: the possible effect of maxillary growth retardation in children below the age of 5 years.

*Forked Flap from Tail of Vomer*

It is possible to utilize the vomerine mucosa for nasal closure of the hard palate in the usual manner and still incorporate posterior extension flaps, shaped like a forked flap, to be transposed bilaterally into velar nasal lining releasing incisions. This maneuver will supply some extra lining for lengthening, without the need for elevation or sacrifice of hard palate mucoperiosteum. It can be
done early and in the primary operation, especially in a bilateral cleft of a short palate where an island flap may never be available.

In 1979 this approach was used in a 3-year-old bilateral cleft of the lip and palate. A midline mucoperiosteal incision along the vomer was extended off the posterior end, circumscribing two posterolateral (forked) flaps (X and Y). This allowed dissection of the usual vomerine flaps which were sutured to the nasal mucosa of the lateral cleft edges of the hard palate. The levator muscle attachments were freed from the hard palate edge and the nasal mucosa divided along the posterior bony border with a release of 0.75 cm. Into these nasal lining defects the forked flaps were sutured and the oral mucoperiosteal closure achieved with von Langenbeck flaps and mattress sutures.

Regenerated vomer flap

Bengt Johanson of Göteborg, combining the principles of "Never throw anything away" and "Get something for nothing," emphasized to me his use of the epithelialized granulation area across the anterior cleft as a flap, no less, to provide some midline lining on the nasal side. It could not, of course, be used to fill a nasal pushback defect.

Personally, I would consider this flap a possibility but also a bit unpredictable since it is hidden on the nasal side where its fate is not easily known.
TRANSPOSITION OF LATERAL PHARYNGEAL FLAPS

The feisty F. T. Moore of Queen Victoria Hospital, East Grinstead, England, designed a secondary procedure which transposed the Hynes-type flaps for nasal lining of the velum (*British Journal of Surgery*, 1960). This obliterated the lateral recesses of the nasopharynx, lengthened the soft palate and produced a mass of tissue on the upper surface of the soft palate to facilitate contact with the pharyngeal wall, and augmented the elevation of the soft palate by a contractile muscular sling. He split the soft palate in the midline to facilitate the cutting of two thick muscular flaps, one from each posterior pillar with the base above. A transverse mucosal releasing incision was then made on the superior nasal surface of the soft palate, about halfway between the uvula and the hard palate edge. The two flaps were transposed 90 degrees, as in a Hynes, but let in on top, across the soft palate, instead of across the posterior pharyngeal wall.

Moore reported that out of 15 cases of rhinolalia from various causes such as cleft palate, congenital short palate and suprabulbar agenesis, normal speech had developed in 12 in three months, with three requiring three to six months of speech therapy.

*Sullivan*

With results like these, it is amazing that more surgeons did not drop what they were doing to follow the same approach. Perhaps the illustrations required too much concentration and imagina-
tion to decipher the game plan. Fortunately, David Sullivan of Spokane personally observed the deft Jerry Moore demonstrating his bilateral pharyngoplasty in 1959. In 1961 Sullivan endorsed the method and reported on 13 cases with rhinolalia in which he obtained normal speech in six but improvement in all.

A 10-year follow-up report in 1971 by Sullivan corrected the title of the procedure to "Bilateral Pharyngeal Wall Flaps to Soft Palate." He reported 26 additional cases, two of which were overcorrected, resulting in denasality and requiring partial reo­pening of the constricted nasopharynx. Moreover, since many of his failures occurred in patients 15 years and older, he preferred to operate at 5 to 10 years, and the earlier in that range the better.

In 1972 Sullivan wrote me more about his experience with this procedure, which he suggested might be entitled "The Irish Connection":

As I have attained experience with this operation, I have noted that I am cutting the flaps broader and not longer. The area I leave undisturbed on the posterior pharyngeal wall corresponds almost exactly with the area which most surgeons use in applying a midline posterior pharyngeal wall flap to the soft palate. The anterior margin of each flap lies immediately behind the posterior tonsillar pillar. Hence the greater the lateral recess, the greater the width of the flap. This has a tendency to standardize the size of the midline velopharyngeal opening which is left. The most obvious correction I would make in my original drawings would be to make the bilateral flaps broader. . . .

After the bilateral flaps have been switched and the donor areas on the lateral pharyngeal walls closed, the suction test is tried and if positive the
surgery is over. If the test is still negative, the need for lengthening the soft palate exists. If the patient’s condition is satisfactory, a V-Y lengthening is carried out at once. Your turned-over island flap has been most helpful in closing the defect on the nasal aspect.

Richard Yules, an otolaryngologist in Worcester, in his 1971 *Atlas for Surgical Repair of Cleft Lip* . . . , illustrated the method from a different perspective in an attempt at greater clarity.

This principle builds another bump against rhinolalia. It has some of the advantages of Hynes’ approach with the reduction of the lateral recesses and merely places the bulge on top of the palate instead of at the back of the throat. It also achieves some lengthening of the nasal mucosa.

**CHEEK FLAPS**

Murari Mohan Mukherji of Calcutta trained in Edinburgh under A. B. Wallace. In the 1969 *Cleft Palate Journal* he proposed cheek flaps as an excellent source of “extraneous tissues” for a number of cleft palate babies. In order to avoid creating abnormal anatomy with a pharyngeal flap or going through the difficult stages of an abdominal tube pedicle—and he has plenty of experience with both—Mukherji suggested mucosal cheek flaps. These pedicles are 1.5 cm. wide and 5 to 6 cm. long, based near the anterior pillar of the fauces; care is taken to avoid the parotid duct.
Mukherji noted that these pedicles, when brought to the palatal region . . . are found to fit comfortably between the soft palate and the hard palate, between the four flaps of the universally accepted Wardill-Veau operation. These cheek flaps are safe even with rotation of their bases and have great versatility. They can be used to line the nasal defect in a pushback and be covered with the standard V-Y oral mucoperiosteal flaps.

Oral Side

They can be used on the oral side in conjunction with a V-Y procedure.

Combination

They can be used in combination, one for nasal closure and one for oral closure, during a V-Y to insure 1.5 cm. pushback.

In 1971, at the Melbourne International Congress, A. C. Ganguli of the Post-Graduate Institute in Calcutta, India, gave Passavant credit for the first use of a cheek flap from the alveolar buccal sulcus. He then advocated bilateral submucous pedicle cheek flaps for both the nasal and oral lining during a releasing pushback procedure. The soft palate was detached from the hard
palate with a through-and-through incision and the soft palate retroposed. The margins of the cleft of the soft palate were pared. A hexagonal flap $1\frac{1}{4}$ inches long and about $\frac{1}{2}$ inch wide was cut from the cheek mucosa along the line from the angle of the mouth toward the commissure. The proximal portion of this flap was taken as a submucous, subcutaneous pedicle so that the flap could be pushed under the mucous membrane from the region of the molar tooth into the palate defect with cover to the raw pedicle. The flaps were taken bilaterally, with one for the nasal and one for the oral side. Ganguli noted:

Taking of flaps from the cheek did not produce any functional disability of the mouth. Follow-up study revealed that the length of the palate was adequate and the mobility of the soft palate satisfactory with efficient velopharyngeal closure.

In 1974 Culf, Chong and Cramer of Philadelphia modified the cheek flap for palate defects described by Ganguli. In *Symposium on Management of Cleft Lip and Palate and Associated Deformities*, with illustrations by D. Leber, they presented their design, applicable when bilateral hemi-palate island flaps were not available.

The buccal island flaps were each outlined as an elongated, diamond-shaped flap avoiding the parotid duct, with the base of the pedicle close to the posterior border of the hard palate but not crossing the alveolar ridge or the pterygomandibular raphe. The buccal mucosa was peeled back to facilitate dissection of a broad subcutaneous pedicle. The soft palate was divided from the hard palate edge in the usual pushback fashion, and the two cheek flaps were interposed into the gaping defect on top of each other, sandwich fashion, for nasal and oral lining.
Ernest Kaplan of Stanford University majored in engineering and minored in art at the University of California, Los Angeles. Thus he was trained in the discipline of measurements tempered with the freedom of art. In 1975 in *Plastic and Reconstructive Surgery* Kaplan proposed a unilateral cheek flap to be turned for nasal lining in any type of pushback procedure when the nasal mucosa has been divided and a defect created. He proposed two possible bases for this flap, which in infants, he suggested, should not be wider than 1.5 cm. (A) The retromolar trigone with the lesser palatine artery in the base of the buccal flap was his favorite. (B) The alveolar sulcus can be used as the base of the flap, but in this case a kink is necessary and the lesser palatine artery is not incorporated into the pedicle.

Using the standard incisions, Kaplan elevates the mucoperios­teal flaps, transects the palatine aponeurosis, cleft muscles and nasal mucosa transversely from the edge of the hard palate, preserves but frees neurovascular bundles, fractures the hamulus, frees the levator muscles from the oral mucosa, leaving it attached to the nasal mucosa, and sutures the muscles and mucosa together. The buccal mucosal flap is cut not to include the buccinator muscle, hinged 90 degrees and pulled through a
tunnel lateral to the greater palatine vessels and sutured into the nasal defect. The mucoperiosteal flaps of the hard palate and vomer are sutured. Kaplan presented diagrams which showed the use of this cheek flap for nasal lining in a von Langenbeck procedure.

There are two other principles by which lining can be supplied to the nasal defect following pushback procedures. They are the island flap and the pharyngeal flap, but both of these will be discussed in chapters of their own.
31. Mending the Misplaced Muscles

The importance of muscles in the palate and pharynx was suspected early, but treatment was misdirected. Fear that the pull of the muscles was responsible for the disruption of the postoperative palate caused fiendish operations to be designed to divide normal musculature to relax wound closure.

Division of Muscles

In 1843 Pancoast modified cleft palate closure by advocating division of palatal muscles and the tendons of these muscles through the Dieffenbach type of incision.

A true interest in muscles in cleft palate was not shown until 1844, when Sir William Fergusson outlined an operation founded on anatomical and physiological data. In fact, he took too much interest in dividing these muscles. These were his words:

With a knife whose blade is somewhat like the point of a lancet, the cutting edge being about a quarter of an inch in extent, and flat surface being bent semicircularly, I make an incision about half an inch long, on each side of the posterior nares, a little above and parallel with the palatine flap, and across a line straight downwards from the lower opening of the Eustachian tube, by which I divide the levator palati muscle on both sides, just above its attachment to the palate . . . then, with a pair of long pointed curved scissors, I divide the posterior pillars of the fauces, immediately behind the tonsils, and, if it seems necessary, cut across the anterior pillars, too; the wound in each part being about a quarter of an inch in extent. Lastly, the
stitches are introduced by means of a curved needle, set in a handle; and, the threads being tied so as to keep the cut edges of the fissure accurately in contact, the operation is completed.

Fergusson admitted:

I have taken no notice of the action of the circumflexus, or tensor palati. I am inclined to think that its action is very limited. . . . I, therefore, without further preamble, propose, as an important accessory to the operation of staphylorhaphy, that the surgeon should . . . so conduct his incisions as to destroy all motory power in the soft palate for the time being and thus permit that repose of the stretched velum which is so essential to a happy result; in other words, I advise the division of the levator palati, the palato-pharyngeus, and the palato-glossus muscles.

Fergusson, repairing hernias in the inguinal region and producing them in the palate, could be dubbed the bad knight of the palate or Sir William the Ripper. He had his favorite thin flat scalpel embellished with a handsome ivory handle, which is on display at the Museum of the Royal College of Surgeons, London. Not only did Fergusson divide muscles, but he inspired others to do the same and more.

In 1846 Liston emphasized the necessity of dividing the tensor palatini muscle. He noted that Fergusson had advised division of the levator palatini and palatopharyngeus muscles with a set of crooked knives. He reasoned:

The union is apt to fail under any circumstances, and I think that this was found to take place in the hands of the above named professor, even after the division of the muscles as he has recommended. . . . If the fleshy belly of the circumflexus (tensor) palati could safely be reached and cut, this would . . . put the parts in a still more favourable condition to come together.

Cutting only the tensor muscle possibly was not too damaging, except for its effect on the function of the Eustachian tube. Yet during this muscle-cutting era from 1850 to 1900, a multitude of surgeons devoted much skill and energy to dividing such muscle structures as the tensor palatini, levator palatini, palatopharyngeus, palatoglossus and the anterior and posterior pillars of the fauces. The black list during this 50-year period included other renowned names: Sedillot, Skey, Browne, Pollock, Garretson, Avery, Agnew, Warren, Trélat, Schuh, Collis, Ehrmann, Collender, Michael, Whitehead, Verneuil and Casselberry.

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Jonathan Mason Warren of Boston, condemning lateral incisions, advised relief of tension by division of the levator palatini and palatopharyngeus muscles. His speech results were probably dismal, but relief of tension must have been achieved, for in 1867 he reported 88 cleft palate successes in closure out of 100 cases.

**Dissenters**

In 1854 Syme deserved a commendation. Against the popular muscle-cutting stream, he had the audacity and the astuteness to question Sir William Fergusson’s myotomy as unnecessary in staphylorraphy. In 1865 Annandale condemned extensive myotomy as done by Fergusson, preferring the von Langenbeck procedure in a single operation. He reported that in one of his cases the mucoperiosteum, which obliterated the gap in the cleft palate, had undergone ossification. In 1870 Tait strongly criticized extensive myotomy but advised that the velum be freed from its connections with the anterior and posterior pillars whenever they interfered with its function.

Sir James Berry was born with a cleft palate; needless to say, his speech was far from good. He was therefore undoubtedly acutely aware of the patients' problems, and this sensitivity led him in the natural direction of the least trauma. In 1905 Berry stated his preference for relaxing incisions over myotomies, and in his much-quoted 1912 book, *Harelip and Cleft Palate*, with Legg, Sir James continued to serve as the good knight, championing the stand against muscle-cutting procedures.

**Billroth III**

Meanwhile, back in the operating room, other less offensive methods of relieving tension were being instituted. More attention was being paid to obtaining good functional results. In 1889 Billroth condemned extensive lateral incisions extending into the velum because he felt these were bound to injure the palatal muscles. He advised section of the hamular process by fracturing it above its connection with the pterygoid plate with a chisel introduced through the posterior extremity of the lateral incision. This is a maneuver that temporarily releases the tensor palati.
action against the cleft suture line. In 1925 Dorrance advocated fracture of the hamulus to aid in the palatal lengthening:

On reaching the tuberosity of the maxillary bone, it will be found that there is still some structure which prevents the palate from falling backwards. This structure is the tendon of the tensor palati muscle. If the hamular process around which this muscle turns at a right angle is broken off, the divided portions will be drawn downward by the pterygopharyngeus muscle. . . . After this hamular process has been fractured you dislocate the tendon of the tensor palati muscle, thus changing its direction so that instead of forming two sides of a right angle triangle it will form the hypotenuse . . . and will allow the lengthening of this muscle and transpose it from a tensor into a levator muscle. This can be demonstrated on any cadaver.

In 1964 R. Ruding of Amsterdam advocated slipping the tensor tendon over the hamulus:

The next step is to lift the tensor tendon from the hamular groove and to detach all insertions of the tendon and the palatine aponeurosis. (Later, after repair, the tensors will have a levator function.) Because the tensor is fibrotic and its tendon difficult to elevate from the hamular groove, it sometimes happens that the hamulus breaks off and disappears. If easily found, it may be removed, otherwise, one may let it go.

**JOINING THE LEVATORS**

In 1912 Ombrédanne of Paris cut the posterior pillars of the fauces near the uvula and sectioned the aponeurotic expansion of the tensor palati muscle by a blunt-pointed bistoury. Through the same incision behind the maxillary tuberosity, he passed a suture on a Reverdin needle around the levator muscles and sutured them together. Many palates and a world war later, Ombrédanne still preferred this approach for cleft palate.
Franz Ernst, pioneer of dentistry, was a forester's son who rose not only to professional fame but also to a high cultural plane. He played violin in the Academic Orchestra and was honored by Paul Hindemith, who dedicated his Concerto for Greater Orchestra to him, and Goetz, who dedicated the comedy *Hokus pokus* to him. During World War I, he worked in Berlin’s Military Dental Institute under Willigen and later under Axhausen. He was the inventor of the Ernst plate made of plastic-celluloid. In 1924 he finished his work on the surgical techniques of handling a cleft palate by plastic surgery.

Ernst is best known to palate surgeons for his development of the "space of Ernst." This is a surgically dissected pocket created by cutting the oral mucosa, the very thin palatoglossus muscle, usually fracturing the hamulus and entering between the pharyngeal constrictor and internal pterygoid muscles—that is, between the masticatory muscles laterally and the pharyngeal muscles medially. He recognized that the musculature of the palate and pharynx had to be reassembled into a position where it could function physiologically. Many surgeons have used the space of Ernst for dissection of the lateral musculature prior to closure of the cleft. Kilner and Peet taught me this maneuver using a blunt dissection down the medial aspect of the medial pterygoid plate to the base of the skull for complete freeing of the structures prior to medial shifting and suturing. Braithwaite based his surgical approach on this dissection.

At the 1964 Hamburg Symposium, A. Immenkamp of Münster/Westfalen, Germany, emphasized the importance of Ernst’s pioneer work:

For nearly 30 years I have done cleft palate repairs after the Langenbeck-Ernst-method. I was fortunate to see Ernst perform his method in Berlin. Wide dissection in the space of Ernst and backwards lateral to the constrictor freed the component "muscle block" of the velopharynx, and it assumed a relatively normal position. When doing push-back procedures of the velum we also use lateral pharyngeal space dissection. We have found that with congenital short palates this method suits the retroposing procedures admirably.

In 1977 Otto Kriens of Bremen repeated his concern about dissections and packing in the space of Ernst:
The space of Ernst is a surgically created pocket, which served the purpose to push the velar muscles medially and to accept a pack, which was left there for 8 to 12 days (or sometimes longer!). Preparing the space of Ernst means to operate outside of the pharyngeal or velo-pharyngeal area. According to Broomhead’s study, the vascular and nerve supply of the velopharynx enters the pertaining muscle from the outside. Thus entering the space of Ernst means: possible damage to this supply and also: leaving the pathology within the velum proper.

**V E A U**

One of the major contributions to palate surgery by Victor Veau of Paris, besides his nasal mucosal closure, was his metallic suture of the muscles. In 1927, in the *Proceedings of the Royal Society of Medicine*, he emphasized the importance of a permanent encircling suture of the musculature on either side of the cleft.

Veau made no attempt to correct the direction of muscle fibers or to detach them from the edge of the hard palate. He used the wire muscle suture for simple closure of incomplete clefts or in a V-Y lengthening procedure in complete clefts.

The most honest evaluations of a man’s worth must come from his peers. George Dorrance, another palate giant, a contemporary of Veau and one not known for accolades to competitors, once said.
Veau’s contribution to cleft palate surgery is outstanding and admirable. The intramuscular suture introduced by him for cleft palate is unquestionably the suture *par excellence*. This aluminum-bronze wire is the most practicable form of suture for holding the split anterior segment of the “palatopharyngeal-sphincter” in its proper relation. We also agree with Veau that the nasal mucoperiosteum is easily stripped off the nasal surface of the hard palate. However, as yet, we are unable to suture satisfactorily this tissue in its entirety.

**WHILLIS**

In 1930 J. Whillis of Guy’s Hospital, London, made dissections to establish the muscular identity of Passavant’s ridge. He found fibers of the superior constrictor muscle inserted into the palatal aponeurosis, constituting a lamella which he felt was responsible for Passavant’s ridge and which he called the palatopharyngeal sphincter. In 1958 Calnan did his best to explode the “myth” that Passavant’s ridge participated in the mechanism of speech, for indeed, his observations of the contractions of this muscular ridge showed it often to be below the level at which the soft palate occluded the nasopharynx. Yet, as pointed out by Braithwaite, it is possible that Whillis’ lamella may serve speech by narrowing the lateral pharyngeal recesses and be a factor in palate occlusion of the nasopharynx when the levator sling contracts.

**OLDFIELD**

The muscular elements of the soft palate, apart from the uvulus muscle and the sphincter of Whillis, consist of four slings. These slings, as noted by Oldfield in 1941, are bilateral muscles gaining their sling-like function through their insertion in the soft palate, the levator and tensor palati with superior origins and the palatoglossus and palatopharyngeus with inferior origins.

**BROWNE**

Denis Browne, a transplanted Australian and an orthopedic and pediatric surgeon working at the Hospital for Sick Children,
Great Ormond Street, London, always had a salty grain of truth in his criticisms to add sting to the wounds caused by his comments. To know Browne was to know his barbs. He said in 1935:

Brophy's operation appeared to me to be a gross mutilation of the whole dental arch for a purpose that could be easily attained in a harmless way. . . . Lane's operation remains a complete puzzle to me. I have never heard of a good functional result from it, and I do not see how one could be attained. . . . Gillies's operation was not nearly ambitious enough. I wanted better results than speech with the aid of a plate needing extremely skilled dental assistance to fit. . . . Wardill's pharyngoplasty, by which he substitutes for the loose and actively rising posterior half of the sphincter a tight mass of scar tissue which drags the sides of the nasopharynx together, appeared to me to go against orthopaedic principles. Apart from my reluctance to destroy the only normal part of the mechanism I was trying to get to work, I had learnt to distrust the permanence of these draggings together and fixations by fibrous tissue.

By 1932 Browne had decided that the nasopharyngeal passage is closed by the action of two overlapping slings of muscle, the superior constrictor aided by the palatopharyngeus posteriorly, and the levator palati with the tensor palati anteriorly. Resenting a less than 100 percent union of his cleft palates, Browne sought a twofold goal: (1) to remove all tension from the suture line and (2) to leave the joined sphincter in the completely shut position. As he said:

No one would suture a ruptured quadriceps or tendo achillis without leaving the limb so that the joined muscle lay in position of contraction during healing, . . . [so] treat the nasopharynx as one would the mouth of a sack that one wanted to keep shut, and tie a string round it.

In 1935 he described his orthopedic procedure for cleft palate. First he removed the tonsils and cut the posterior palatine arteries. Three months later, and after 18 months of age, he made two breathtaking lateral gashes from the canine tooth in front, backward just inside the teeth, then along the pterygomandibular raphe, cutting the anterior pillars of the fauces off the tongue. No wonder he ridiculed plastic surgeons' horror at large raw areas in the palate region. Blunt dissection through these canyon-like incisions moved the palate elements medially.

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Then Browne got out his $1/16$-of-a-circle needle carrying a double suture of 40-day No. 1 chromic catgut mounted on a pistol-grip needle holder. When aided by his "needle-catcher" forceps, he was able, after much practice, to pass this cord around the back of the throat behind the superior constrictor, exactly in line with Passavant's pad. With a second bite, he completed the buried circle through the two halves of the palate. After the cleft edges had been sutured, the ring stitch was tied snugly and served to splint the cleft union as well as gather the velopharyngeal sphincter with a semi-closed and somewhat rigid ring. In 1948 at Great Ormond Street Children's Hospital, I saw him complete his palate operation in 20 minutes.

Browne reconfirmed his satisfaction with this method in 1955 at the International Congress in Stockholm. He reported spontaneous remarks on improvement in speech by parents and friends of almost every patient. Evidently few, if any, palates dared to separate once he had instigated this purse string. But then, few, if any, separate without a purse string.

In spite of his barbs and because of his work in all aspects of pediatric surgery, Browne was eventually knighted Sir Denis.

Braithwaite

Fenton Braithwaite, a student of muscle physiology, even in his free time concerns himself with muscle coordination, being a director of Newcastle United, a professional football club with a high tradition in England. As Wardill's worthy successor in Newcastle upon Tyne, he continued to improve muscle efficiency in palate surgery. In Gibson's 1964 *Modern Trends in Plastic Surgery*, Braithwaite described and illustrated the speech mechanism of two muscle slings—the *levator*, descending on each side from its origin on the petrous bone passing downward and forward, and the *palatopharyngeus*, passing forward and upward. The levator arch elevates the soft palate in a backward and upward direction while the palatopharyngeus approximates the palatal arches and narrows the pharynx. These two loops with their common insertion in the palate counter each other, and the
pull converts the U loops to Vs and the entire mechanism to an X. When looking through the patient’s mouth, one can imagine this muscle action like the opening and closing of a pair of scissors. In profile the effect on the soft palate is shown during contraction of the levator and palatopharyngeus muscle.

Before the patient was 6 months old, Braithwaite united the lip and achieved a one-layer Veau-type closure of the nasal floor and anterior hard palate. Between 1 and 2 years he used a Ganzer-type V-Y operation, but his dissection had a special design. First he elevated his palatal flaps, isolated the posterior vessels and freed the mucosa from the nasal floor. The aponeurosis of the soft palate was divided from the edge of the hard palate, leaving the nasal mucosa intact. The hamulus was fractured and the fibers of the superior constrictor, along with the hamulus, were pushed medially and dissected radically from the medial pterygoid plate. This dissection was carried deep into the space of Ernst and backward around the lateral pharynx, moving the constrictors medially with the soft palate. The edges of the cleft were dissected so that the levator attachments could be divided and freed into robust bundles which were sutured together to close the levator sling. In 1968 Braithwaite reemphasized this maneuver as

of great importance in the production of a palate with maximum mobility. This step consists in the careful dissection of the fan-shaped levator palati following its separation from the posterior edge of the hard palate so that it becomes a compact bundle before it is sutured (with widely placed mattress sutures) to its opposite number.
The lateral spaces were packed with gauze soaked in Whitehead's varnish and left for 10 days to support the sutured palate during the healing phase. Upon removal of the packs, Braithwaite claimed, the space was occluded in 48 hours as the adjacent tissues of the neck moved medially.

It was Braithwaite's theory that, once the superior constrictor's hamular and lateral attachments were freed, the soft palate aponeurosis from the hard palate was released and the levator sling was joined across the cleft, the pull of the sutured levator would maintain palatal length in spite of an intact nasal mucosa.

Spontaneous development of normal speech was usual following modern operations in infancy. Speech therapy was required if speech had not developed properly by 4 or 5 years of age. Braithwaite reported in 1964 that 19 percent of cases required a short interval of speech therapy and 10 percent a longer interval. Seventy-one percent were normal without therapy. Assessment of 290 children over the age of 4 years with operated clefts revealed 58 percent normal, 24 percent with articulation defects (8 percent of these being minimal s distortion) and 9 percent with nasopharyngeal incompetence, incoordination or anterior fistulae. There was another 9 percent not reported.

Cognizant of Braithwaite's priority in construction of the levator sling in cleft palate and his reputation as a silver-tongued after-dinner speaker with an elephantine memory, I challenged him to retrace his early experience. Here are some of his reflections:

When the war came, the leading lights of English Plastic Surgery sprayed themselves and their units to country sites at safer distances from London's centre. I remained at Barts under the 'blitz' and, after the war, was transferred to East Grinstead with McIndoe. During the clinics and outpatients I noticed that everyone discussed speech in relation to "Push-Back" of the cleft or short palate. I recalled seeing in various types of injury that the levator palati muscles and the palato-pharyngeus acted as a pair of scissors. This is obvious if the palate or tonsils are touched by a probe; the tonsils are forced inwards, helped by a simultaneous contraction of the upper portion of the superior constrictor. It is also seen, on dissection of a cleft, that some fibres of the levator palati are attached to the posterior edge of the hard palate. If the scissor-like action of the palatal and pharyngeal muscles is to be restored, this complex must be freed of abnormal attachments and...
given normal attachments by surgical suture. This was first discussed by me at East Grinstead in a surgical meeting. It was not met with enthusiasm, being overwhelmed by the popular mixture of “Push-Back” and Passavant.

At Newcastle upon Tyne, to which I was appointed in January 1949, I had the opportunity to try this concept. Dissection of the upper fibres of the superior constrictor muscle from its attachments to the pterygoid lamina allowed a further “pull in” of the superior constrictor. At the same time a blunt dissector could be inserted lateral to the upper pharyngeal muscular group and the latter freed from fascial attachments. The palato-pharyngeus and levator-palatal muscles can be dissected within the soft palate. The fibres of this group are augmented by the fibres which have been dissected from the hard palate and appear as an obvious muscle which just invites suture. These results were presented as routine “follow-up” patients for Dr. Muriel Morley’s assessment and criticism. Her opinions of the success of this approach were reported in her well known textbook.

Dr. Betty McWilliams from Pittsburgh visited my unit, to confirm or dispute the results that had been publicized by Dr. Morley on the latter’s visit to the U.S.A.

McWilliams recalled her visit with Braithwaite and Morley in Newcastle on Tyne:

A four-year-old with a repaired palatal cleft was finding it difficult to talk to the visiting American, who, his mother had unwisely told him, had come all the way across the ocean on a big airplane just to see him. Needless to say, he was scared speechless. Mr. Braithwaite suggested that an eight-year-old brother be invited to join his little brother in the hope that things would be a bit less tense. The eight-year-old was quite self-possessed and readily entered into conversation. His speech was extremely British and altogether delightful.

Falling easily into the surgeon’s trap, I asked Mr. Braithwaite if we could get permission from the boy’s mother to tape-record the speech of the older child as an example of not only normal but superior speech in a British male child. Mr. Braithwaite calmly replied, “I repaired his palate when he was a year old.” That was a real test of excellence that is usually not possible except in controlled experiments. I did not know the boy’s history, and he did not reveal it in his speech pattern. The goal for him had been attained.

Braithwaite concluded:

Delay in publishing these results was due to my feeling that many people published their results too early and with too few examples. Matthew Arnold, the poet, implied in his opinion “the lawless eclectic of a spurious
impressionism" did but ill favour to the uninformed who followed. I did
not feel disposed to contravene the couplet:

"Be not the first by whom the new are tried,
Nor yet the last to lay the old aside."

Dr. Morley in 1961 examined 360 children who had been operated on by me
according to this technique. The results are recorded in the sixth edition of
her book *Cleft Palate and Speech*. I gained comfort from the fact that I
appeared to be doing no more harm to my patients than anyone else did to
theirs and that I had waited for 360 patients to attain an age of five to ten
years before I published the results. This method was discussed as you know
at Schuchardt’s Second Hamburg International Symposium in 1964 and
presented in Gibson’s 1964 *Modern Trends in Plastic Surgery, I.*

RUDING

In 1964 in *Plastic and Reconstructive Surgery*, Roelof Ruding of
Amsterdam, the Netherlands, a general surgeon interested in
clefts, presented an excellent study of palate musculature with
logical suggestions for surgical correction. He noted that the path
of the levator muscle lies within the arc of the inferior curve of
the posterior rim of the medial pterygoid plate, and upon con­
traction of this muscle, it moved away from the plate in a
posterior direction "much as a slack line leaves the ground when
it is drawn tight.” He warned:

Any operation where intensive dissection is done in the region of the
posterior rim of the medial pterygoid plate runs the risk not only of injuring
the pharyngeal orifice of the auditory tube but also leads to scarring and
fibrosis within the levator muscle. Whereas the tensors can be eliminated,
the levators cannot be eliminated with the retention of normal speech.

His description of the levator muscle in relation to the palate
was concise:

The fibers of the levator pass in three directions. The anterior fiber bundles
bend forward in a sagittal sense and insert in the palatine aponeurosis. The
posterior bundles bend vertically, coursing downwards, and end in the
uvula. The greater and bulkier part of the levator fibers continues between
the anterior and posterior fibers to meet in the midline with fibers from the
opposite side. A levator loop is thus created. Starting with the diameter of about 1 cm, this muscle then broadens into a flat muscular sheet measuring approximately 2 to 2.5 cm.

Ruding discussed the two notorious muscle loops:

The combined action of both the levator palati and the superior pharyngeal constrictor on both sides produces the nasopharyngeal sphincter. The lateral fibers of both muscles, coursing to their separate attachments, cross each other. The palatal pharyngeal sphincter of Whillis is comprised of portions of both the levator palati loop and the superior pharyngeal constrictor loop. The posterior portion of the palatopharyngeal sphincter belongs to the constrictor; its anterior part to the palatal muscles. According to Whillis [1930], its anterior insertion is on the palatine aponeurosis, and according to Holdsworth [1951] some bundles unite with bundles of the other side. In both cases we can consider that a sphincter has been formed. Baggerman agrees with Whillis.

Ruding also discussed the palatopharyngeus muscle running in the posterior pillar and the palatoglossus in the anterior pillar, summarizing:

Together with the tongue, these palatopharyngeal and palatoglossal muscle loops form the oropharyngeal sphincter.

He did not give justice to the uvular muscle, stating:

The uvular muscle is not very important and in the surgery of cleft palate is totally unimportant.

(David Dickson, as previously described in “Anatomy,” considers this muscle important with its longitudinal contraction, like the humping of an inchworm, forming the "velar knee.")

The exciting part of Ruding’s presentation was his logical correction of the misplaced anatomy by surgery. He noted:

In the case of cleft palate, all the muscles and tendons which are normally found do indeed exist, and their origin is the same. It is their insertion which is abnormal. . . This is particularly true of the insertion of the levator which is the most important muscle. This more anteriorly and medially situated portion of the muscle is called muscle de la fente (fissural muscle) by Veau.

Ruding mentioned that E. Baggerman in Amsterdam had dissected a fissure in which these bundles were macroscopically
well visualized. Just like the lateral portion of the insertion, this medial part was very firmly attached to the mucosa, giving the impression of a scar. Ruding conjectured:

The ideal operation should imitate as completely as possible embryologic development: as the cleft is closed in utero in an anteroposterior direction, the palatal musculature also moves posteriorly to finally establish itself in a plane which is posterior to the plane through the hamular processes. The fibers of the musculature, as they follow the closure of the cleft, will change their directions from a nearly anteroposterior one to a nearly laterolateral one, so that when final closure of the cleft is complete in utero, all fibers destined to become bundles of muscle will have joined with their partners of the opposite side directly or through the palatine aponeurosis in midline conjunction with each other. Surgically, this can be obtained by carefully detaching every muscle and tendon fiber from their insertions to the bone and then by suturing in the median plane as many as possible of these detached insertions. The more successful this suturing technique, the more muscle fibers will take part in the construction of a true levator loop. . . . The important part is that the muscles, no longer fixed anteriorly and laterally, may now become effective forces modeling function and growth to obtain a more normal closing mechanism.

Ruding also advised ostectomy of the posterior rim of the foramen to let the greater palatine artery move backward and the lifting of the tensor tendon from the hamular groove and detachment of all insertions of the tendon and the palatine aponeurosis without great concern for the hamulus if it should be fractured in the process. He did emphasize dissecting the muscles and aponeurosis from the nasal mucosa and mentioned small lateral cuts for a minor release or larger cuts at different positions for a Z-plasty and even a wide, transverse release to be covered on the nasal side by a free skin graft, as he described in 1955. He concluded, however:

For most clefts of the palate these lengthening procedures are not necessary.

KRIENS

In 1967 Otto Kriens of Hamburg had the opportunity to dissect a stillborn bilateral cleft baby in Karfik’s unit in Prague, and found that Veau’s “cleft-muscle” was the common anterior
portion of the levator and palatopharyngeal muscles. The superior constrictor pharyngeus muscle was the only intact muscle sling in the cleft palate. Further study by Kriens of the anatomy and applied physiology of palatal musculature threw some new light on their use in speech and Eustachian tube function. Kriens found:

In the normal soft palate there is the palatal aponeurosis and posterior to this the muscular velum. Muscle fibers of isotonic action intermingle in a predominantly transverse course through the palate.

The three muscular slings of the normal velo-salpingo-pharyngeal apparatus act isotonically. Their contracture leads to the occlusion of the velopharyngeal opening. During the same action, the levator palati elevates the medial edge of the tubal cartilage. This opening movement of the Eustachian tube is furthermore afforded by the downward pull of the lateral edge of the tube by the tensor muscle and indirectly by the levator muscle which elevates the contracting salpingo-pharyngeal muscle.

Cleft Palate

Functional synergism of the velo-salpingo-pharyngeal muscles is impaired in the cleft palate with the exception of the superior pharyngeal constrictor. The other muscles of the cleft palate have ipsilateral origins and insertions. The levator palatii extends in a bow across from origin to insertion on the same side of the head and thus contracts laterally, forward and upward instead of backward and upward. This causes the palatal halves to be pulled to the sides more than posteriorly!

A similar dysfunction is present in the lateral epipharyngeal wall around the levator palatii muscle. Since the muscle does not join its mate to move dorso-cranially it deviates instead craniolaterally so that the medial edge of the Eustachian tube is not elevated.
In cleft palate the levator space is retained during contraction of the muscles as long as the cleft-muscle is adherent to its attachments. The detachment from its insertion at the oral mucoperiosteum and from the cleft posterior nasal spine and the formation of a muscle sling through the soft palate are prerequisites for an improvement of an effective interplay of the palatal muscles around the levator space.

**A Warning**

Any intervention near the epipharyngeal portion of the Eustachian tube seems to offer a possible hazard. The fracture of the hamulus may easily lead to a disruption of the musculo-tendinous apparatus near the tube. Worst of all—as far as the subsequent damage is concerned—seems packing of the space of Ernst: immediate disturbance of the equilibrium of the muscle interrelations around the levator space and later scarring.

The attachments of Veau's cleft-muscle, especially its position in relation to oral mucoperiosteum and to the posterior nasal spine, retain the lateral position of the velar stumps and **have to be freed**.

Intervention other than elevating the nasal mucoperiosteum and dissecting the fibers attached to the bone should be avoided. If an immediate elongation of the nasal layer is necessary, a retro-displacement after Stark or Cronin or with Millard's island flap should be resorted to instead of severing the muscle attachments at the nasal lining. The latter intervention involves a great risk of a breakdown of the nasal lining with subsequent scars and fistula.

According to Kriens, after the cleft-muscle on each side has been shifted dorsomedially and the levator sling formed, closure of the cleft palate is easy. As Blair and later Widmaier did, he closed his lateral incisions with flaps of buccal mucosa.
MR. DEANE COMES TO MIAMI

Soon after the arrival in Miami of astute Malcolm Deane, a registrar in Bristol on a Maytag Fellowship, we were introduced to the adjunct of direct dissection of the fanned-out levator muscle into two discrete muscle bundles as previously described by Braithwaite. In 1970 a modification of the Braithwaite approach was published with less radical lateral dissections but utilization of his muscle dissections just before dividing the mucosa along the edge of the hard palate—to maintain a fixed point and thus facilitate this part of the surgery. The nasal mucosa is then cut along the posterior edge of the hard palate, allowing the entire soft palate to shift backward. Once freed from their anterior tethering, and developed into two bulky muscle bundles, the levator muscle stumps could be closed into an intact sling by direct suturing. The island flap is then inserted to insure and maintain the repositioning.

It seemed that if direct levator suturing were used as an adjunct, in addition to the island flap for nasal mucosal lengthening, total palatal function should be facilitated even further.

HOOPES

In 1969 John Hoopes, A. L. Dellon, J. Fabrikant and A. Soliman, using cineradiographic evaluation of the vocal tract with synchronous sound recordings as described by Hoopes and Fabrikant in 1968, found a significant difference between patients with submucous or visible cleft palates and the controls, and also between submucous cleft palate and visible cleft palate groups with reference to one another. They found:

The more anteriorly the levator veli palatini is inserted into the soft palate, the greater is the degree of velopharyngeal incompetence and the greater is the degree of hypernasality (a higher numerical speech rating).

DELLON

Evidently A. Lee Dellon was a precocious student at Johns Hopkins University School of Medicine. In 1977 he recalled:
Following the first cine studies with Dr. Hoopes, it became clear that for velopharyngeal incompetence, with a cine-documented anterior displacement of the levator, the ideal repair would correct this anomalous location. I was still in medical school and went to the anatomy lab at night, when the students had gone, and took the sagittally sectioned heads, on which the velopharynx was usually untouched, and worked out the procedure. Dr. Hoopes was then at Barnes. I brought Dr. Edgerton to the lab one afternoon with his camera, and he was very supportive of our efforts. To have the least ambiguous clinical trial, I thought we should try this on non-cleft patients with congenital VI, whose only problem was a cine-identified anterior insertion for the levator. We reported our small series (4) in the Surgical Forum first; it later appeared in P and R S. The procedure grew out of a clinical problem, evaluated by clinical research, taken to the lab and then back to the patient.

In 1977 John Hoopes referred to his cineradiographic studies with Lee Dellon as having satisfied him that the position of the levator sling is the important determinant with regard to speech results after palatoplasty. He noted:

On the basis of the investigations performed by Dr. Dellon and myself, Milt Edgerton advocated specific dissection and retro-displacement of the levator muscles. This procedure is theoretically correct anatomically and physiologically; however, the speech results in the limited number of isolated levator dissections and retro-displacements performed in our institution have not been acceptable. I tend to suspect that the poor results are attributable to the excessive scarring associated with extensive dissection within the soft palate.

EDGERTON

Always quite quick to recognize a good thing and to adopt it like "a duck on a June bug," Edgerton was attracted to the levator muscle retropositioning of Braithwaite, Ruding and Kriens. In 1971 with Dellon, Edgerton advocated exposure of the levator muscles through a midline oral mucosal incision in incomplete clefts and congenital palatal insufficiency and through the pared cleft edges in incomplete clefts. They then described dissecting the oral mucosa as flaps off the underlying muscles and continued:
Starting in the midline, the levator insertion (plus a small segment of aponeurosis) is separated from the bony palate and turned posteriorly, taking care not to disrupt the nasal mucous membrane, lying deeply above the soft palate. The dissection is then carried laterally and posteriorly to the point where the cord-like portion of the levator muscle may be seen originating from the lateral pharyngeal wall.

When this dissection has been completed and the levator is freed from connections to the bony palate, there will be a natural tendency of the levator insertion to retract posteriorly toward the uvula. . . . The two levator muscles are dissected free, as if they comprised the "meat" of a sandwich (with mucous membranes forming the "slices of bread" that are left intact on both the nasal and oral surfaces).

At this point in the operation a satisfying relaxation of the entire soft palate may be seen.

This has been an interesting description, but nothing really new has been added to Braithwaite's, Ruding's and Kriens' work. Edgerton's twist follows:

To help maintain a more posterior position of the levator insertion, we have elected to roll the insertion over on itself 180° before suturing it to the uvulus muscle near the base of the uvula. The oral mucous membrane layer of the soft palate is now closed, if no additional pushback of the soft palate is required.

PERKO

In 1974 Milivoj Perko of Zurich, in an attempt to reduce surgery's effect on maxillary growth, left the periosteum and the neurovascular bundles on the hard palate. He dissected the oral mucosa as rather hazardous flaps for exposure of palate musculature and detached the levator muscles from the edge of the hard palate, freed them from the nasal mucosa and then united them in a muscle sling.

WALKER

Dennis Walker of South Africa has devised a conservative muscle-releasing trick which he described to me in 1977:

A sub-mucosal muscular release at the back edge of the hard palate is possible by slipping McIndoe scissors transversely between the oral and nasal mucosal layers.
KAPLAN

In 1975, while advocating correction of the position of the misplaced levator muscle and contraction of its sling, E. Kaplan reviewed the various methods used by surgeons to accomplish this goal. Braithwaite and Maurice, he noted, originally separated the levator muscle from the nasal mucosa and rotated the halves of the levator muscle and attached oral mucosa together as composite units. Kriens (1969), Millard et al. (1970) and Fára et al. (1970) all advocated methods of levator sling reconstruction during primary closure of the cleft. In 1971 Edgerton and Dellon as a secondary procedure dissected the levator muscle from both the oral and nasal mucosa prior to retrodisplacement. Kaplan then chose the only other possibility: separating the oral mucosa of the soft palate from the palatine muscles so that the levator muscle and the nasal mucosa could be rotated as a composite unit. He argued that this lack of dissection of the nasal palate mucosa produced less scar, less resultant restriction and less risk of devascularizing or injuring the levator muscle.

RANDALL AND OTHERS

In 1975 at the Sixth International Congress in Paris, Peter Randall presented an application of overlapping the levator muscles in soft palate closure, similar to overlapping orbicularis oris muscles in bilateral cleft lip. Referring to his overlap, he reasoned:

Hopefully, this tightening of the "levator sling" will produce a better levator eminence and improved V.P. competence.

He advocated a primary procedure with elevation of the usual V-Y mucoperiosteal flaps, dissection with difficulty of the levator muscles from the nasal mucosa, nasal mucosal lengthening with Z-plasty and overlapping of the levator muscle strands prior to replacement of the mucoperiosteal flaps. His design of the crisscrossing muscle overlap following closure was presented along with photographs of the final closure. This much primary surgery in the growing child may not stand the test of time.
In 1975 John Mulliken, F. Giargiana, G. Claybaugh and J. Hoopes of Johns Hopkins Hospital noted some interesting findings in relation to retropositioning the levator muscle:

In our institution, over the past five years, the levator retropositioning procedure was combined with standard Veau-Wardill-Kilner pushback and superiorly-based pharyngeal flap procedure for velo-pharyngeal incompetence; in most instances, anterior displacement was documented on pre-operative ciné study. This retrospective evaluation of our 20 patients has revealed the following:

1.) Combined palatal pushback, levator retropositioning, and pharyngeal flap procedure does not give a change (over 4 mm.) in levator insertion. Only 2 of 12 patients demonstrated remarkable retrodisplacement, and one of these had little improvement in post-operative speech. Yet 10/12 patients demonstrated satisfactory improvement in speech.

2.) Levator retropositioning when employed alone resulted in significant retrodisplacement . . . but the subjective improvement in speech was minimal.

3.) Pharyngeal flap, either alone or when combined with palatal pushback, resulted in anterior levator displacement in 4/6 patients with normal or posterior pre-operative levator position. Yet, speech improvement occurred in all 4 patients.

4.) The post-operative rate of velar ascent was slowed or unchanged following all operative procedures.

These observations indicate that when correcting a pre-operative anterior levator position, the post-operative location of the levator insertion is unpredictable—with the possible exception of levator retropositioning alone. Earlier studies suggest that the island flap pushback and pharyngeal flap also may give predictable levator retrodisplacement.

In conclusion, they made these observations:

Patients with normal or posterior levator insertions pre-operatively all demonstrated post-operative anterior displacement following pharyngeal flap procedures, either alone or in combination with pushback.

Anterior levator displacement may be the result of scar contraction or division of the levator sling (during insetting of a pharyngeal flap).

Toyomi Fujino of Keio University, Tokyo, who trained in the U.S.A. under Bernard, Hoffmeister, Bakamjian and Converse, tries to live by "Ki Shu Butsu Shin," which he translates as "A surgeon uses a devil's hand but with the mercy at the heart of..."
Buddha.” In the 1977 *Keio Journal of Medicine*, after 20 years’ experience with the Wardill operation, he presented a microsurgical closure of the soft palate cleft in 10 cases. The operation involved a U incision made around the cleft, a whole-layer Z-plasty over the palatopharyngeal muscle just in front of the uvula and oral mucosal flaps (A and B) at the level of the posterior edge of the hard palate (I). Under the operating microscope (5–6 × magnification), the levator muscle fibers were dissected with excellent visualization from the oral and nasal mucosa only two-thirds of the length from the cleft edge to the retromolar region, preserving the lesser palatine nerves. The muscle bundles were transposed into normal position, flaps A and B were rotated and advanced and a full-thickness Z-plasty of the distal velum was accomplished (II). Following suturing, there was an anterior oral raw area between the hard and soft palate (III) which was reported healed in one month. By not exposing the retromolar region and not severing the lesser palatine nerves, Fujino predicted:

We expect a better growth of the maxillary and palatal bones, and less chance of anesthesia of the soft palate and of atrophy of the mucosal glands. The uvular muscle function would also be preserved, but contraction of the raw area is a drawback.

Fujino cites a testimonial for his operation from a mother 11 days after surgery on her 19-month-old girl: “Doctor, my child speaks so clearly after the operation.” Then speech therapy was discontinued after seven months because of normal speech.

Leonard T. Furlow, Jr., of the University of Florida, who has suggested testing for velopharyngeal incompetence using a film of soap solution over the nares, suggested that his epitaph might read: “His ingenuity was obscured by his procrastination.” At the 1978 Southeastern Society of Plastic and Reconstructive Surgeons meeting, in typical low-key manner, he presented his ingenious rendition of palate lengthening and levator muscle retropositioning by means of composite oral and nasal Z-plasties with mucomuscular flaps. One of the nasal mucosal flaps carries the right anterior half of the levator muscle while one of the oral mucosal flaps carries the left half of the muscle. By transposing the four flaps in a double Z he gains 1 cm. in length and lines up
the levator fibers in an intact loop. Here is his description of the method:

The z-plasty closure is loosest at the end of the lengthened diagonal. Thus one can lengthen the palate, transpose and retroposition the palatal musculature, and relax the difficult area at the junction of the hard and soft palate. The middle limb of each z-plasty lies along the cleft. The ends of the transverse diagonal are at the level of the hamulus, placing one lateral limb approximately along the posterior margin of the bony cleft (A). On the oral side, the posteriorly-based flap is elevated to contain the musculature. The anteriorly-based flap is composed of mucosa only, elevated from the underlying muscle (B). The nasal z-plasty is reversed, so that the posteriorly-based flap contains the muscle of the opposite side and the anteriorly-based flap is of mucosa only (C).

When the flaps are transposed, the muscles are transposed with their posterior flaps into a more posterior and transverse position overlapping to approximate a more normal muscular sling (D, E).

The greater palatine vessels are critical to the oral side flaps. They supply the mucoperiosteal flap on one side and the mucoperiosteal flap and the anteriorly-based z-flap on the other, and absolutely must be protected. If, after elevation of the mucoperiosteal flaps and mobilization of the greater palatine neurovascular bundles, there is any question of their continuity, the z-plasty repair should be abandoned in favor of a straight-line or other more standard repair.

At the time of presentation, Furlow apologized for having only three cases with short-time follow-up. He explained, however, that at the rate he was getting palate cases, by the time he had long enough follow-up he probably would have had only three more.

This is an interesting concept which was applauded by moderator Randall and, in fact, may have potential promise.
In 1978 in the *Journal of Maxillofacial Surgery*, Claus Walter and Hans-Henning Meisel of Düsseldorf proposed a similar type Z of soft palate flaps. With less sophistication in handling the muscles, they noted:

The soft palate is divided into two halves without regard to the muscle fibers involved. This means that no attempt is made to separate the muscle tissue from the nasal or oral mucosa.

They summarized:

With this procedure we are also able to shift the centre of muscle function further dorsally, thus achieving a lengthening of the palate as well.

Do not forget that many large flaps make much scarring. More important, as in all Z-plasties, the gain in length must be paid for by decrease in width or in side-to-side tightening, which, in even the moderately wide cleft, may cost too much in general restriction.

**THE VELAR STRETCH**

Obviously, since the hole is open at rest, during velopharyngeal closure the soft palate must stretch backward unless the pharynx prefers to project forward. A bit of both is probably the usual phenomenon. In 1969 S. Pruzansky and Robert M. Mason of the University of Illinois first described the velar "stretch factor":

Lateral cephalometric X-rays showed that in some individuals the soft palate (velum) increased in its intrinsic length during velopharyngeal valving. This
"stretch factor" (SF) is significant since the potential of the velum to produce velopharyngeal closure is not always predictable from its resting length. That is, the resting length of the velum may be shorter than the anteroposterior diameter of the nasopharynx.

Among patients demonstrating varying degrees of palatal insufficiency, the SF for the consonant /s/ generally exceeded that for the vowel /u/. The differential is, in part, related to differences in intraoral air pressure, total cavity size, and the muscular effort necessary for their production. The valving differential between these sounds is constant for a given patient but varies between patients . . .

In 110 [adult] patients with congenital palatopharyngeal incompetence, the velum exhibited elevation on phonation without complete velopharyngeal valving. The affected soft palates did not differ from the controls as much in resting length as in thickness. Diminished velar thickness suggested an intrinsic defect in the muscular components that constitute the velum . . . . The SF is an active process . . . dependent on the load imposed, the available muscle mass, the range and speed of movement, and the activity of other muscles involved in the synergy.

In 1972 R. K. Simpson and A. A. Austin measured a 20 percent average increase in the length of the soft palate during activities associated with speech in 20 normal adult speakers. In 1975 Arthur P. Mourino and Bernd Weinberg of Richmond, Virginia, made a cephalometric study of velar stretch in forty 8- and 10-year-old children who spoke normally. They found:

Although 36 children (90%) exhibited velar stretch during the production of /u/ and 32 children (80%) exhibited stretch during sustained /s/, in 12 observations velar stretch was not present during speech . . . . On the average, 10-year-old children exhibited significantly greater velar stretch during both /u/ and /s/ utterances than did 8-year-old children . . . [and only half the amount reported in adults]. These observations suggest that the average degree of velar stretch may increase as a function of chronologic age.

It is vital that closure of the palate cleft not interfere with but facilitate the ultimate velar stretch. Detachment from the bony edge, reconstruction and retropositioning of the levator muscle sling with careful approximation of the remaining velar musculature with minimal scarring set the stage. Interruption of the straight-line scar of union aids stretch, and maintenance of palate lengthening reduces the amount of stretch necessary. Both of
these adjuncts are increased by oral mucoperiosteal pushback relieved on the nasal side by a Z-plasty or, better, by introduction of new tissue such as an island flap, tip of a long pharyngeal flap or cheek mucosal flap or by sliding the nasal mucosa.
Development of the Palatal Island Flap for Nasal Lining

O N L Y after years of observation and experience can one know where the faults lie, gain some understanding of their cause and effects and begin to consider possible solutions. My training peregrinations were a great opportunity to observe many of the palate giants of the 40's. From 1944 to 1959 I saw MacCollum and Douglas do von Langenbeck procedures, Gillies do the Gillies-Fry operation, Wardill, Kilner, and Peet do V-Y pushbacks, Récamier do a Veau closure, Brown, Byars and McDowell do their pushback, Wardill and Hynes do their pharyngoplasties and Denis Browne place his circumpharyngeal purse-string suture. Throughout all of this the shortness of nasal lining concerned me, and in a 1949 discussion with Bill Holdsworth I learned that McIndoe often released the nasal mucosa anteriorly to aid in pushback of the palate.

THE HUMP

My first observation of a pushback using the horseshoe-shaped mucoperiosteal incision with the division of the nasal mucosa along the posterior edge of the hard palate was in St. Louis in 1950. Of course, as Brown described earlier, he and Byars did not divide the greater palatine vessels but freed them from their foramen and the flaps to facilitate extra lengthening. The impressive pushback then placed the anterior tip of the mucoperiosteal flap all the way back to the posterior edge of the hard palate, causing what looked like a breathtaking retropositioning when viewed from the oral side. There was a noticeable transverse
humping of excess mucoperiosteum on the oral side and also a large raw area on the nasal side. This double discrepancy troubled me, but as Brown had always cut and run before I could phrase a diplomatic question, I finally turned to Byars.

These pushbacks, sir, have a large raw area on the nasal side. There has got to be some contraction?

Beneath his quiet reserve, Byars occasionally allowed a little friendliness to show. He answered:

Yes, but we overcorrect and, by forcing the excess to fold into a hump we counteract enough of the contraction to attain sufficient length.

The authoritative dignity with which this semilogical reply was delivered diverted me for some time.

While writing "The Principles and Art of Plastic Surgery," Gillies and I were also operating on a number of secondary palates. As we said in the book:

Too many soft palates are too short and tight, so that speech is far from normal. Anywhere else in the body, when there is not enough local tissue we merely bring in some from afar; why should we discriminate against the palate?

Gillies became interested in introducing a tube pedicle into the palate cleft in secondary cases and later decided to try it primarily in children. He noted that even the Veaus and Kilners could claim no better than 75 to 80 percent good results. He said:

This leads to the supreme question. Can we, in that "other 20%," avoid alveolar distortion, attain good speech and have no call for an obturator? The answer lies in the introduction of new tissue . . . at the primary intervention. Or is this swinging the pendulum too far?

His first primary attempt was made on a little girl who had a wide cleft in a short palate. I assisted and remember that the fat pedicle attached to her wrist was almost too big to enter her mouth. By the seventh day, she had dislodged the pedicle with her tongue.

This served as a challenge for me to take an abdominal tube pedicle into the palate in a bilateral cleft in Korea, thinking that
it would be the first successful primary tube pedicle to the palate cleft. It was not, but this was the last time I ever used a tube. There had to be a better way!

The Scylla and Charybdis of the palate cleft, once two ominous monsters, mortality and infection, had been eliminated after anesthesia, antibiotics and many a surgical Odysseus. In their place stood two lesser monsters, tension and contracture. They now threw an unfavorable shadow on the cleft, particularly when it was wide and the palate short. The majority of clefts were being dealt with quite effectively by popular methods. The closer one approaches 100 percent in any field, the more difficult each of the last percentile points is to earn. Herein lies the challenge.

There was a definite need for improvement as surgeons were acknowledging, even at best, a relatively high percentage of failure: 26 percent in France, 20 percent in England and 25 percent in America. Function seemed to demand effective lengthening in certain cases while the difference in techniques appeared to have only a minor influence. The V-Y pushback, with mere freeing and stretching of the nasal mucosa without division at the hard palate edges, produced limited and uncertain lengthening. Calnan at Oxford, questioning the consistent, long-term effectiveness of V-Y pushback lengthening, cited the scarred area of the common oronasal fistula as a possible factor in subsequent shortening.

There is one "drawback" to all pushback procedures which eventually, at least in part, results in pulling forward what has apparently been adequately pushed back. This is the raw nasal surface, which is in exact proportion to the amount of initially obtained soft palate lengthening. It is elliptical in shape and is created when the nasal mucosal attachment of the soft palate to the hard palate is divided transversely, allowing the soft palate to shift back a centimeter or two. All surgeons who had favored a pushback in short palates had been justifying a small blind spot in principle when they discounted the obvious nasal contracture and binding of the soft tissue with the statement that such length had been achieved that subsequent partial shortening was of no great concern.
Baxter, Dorrance and Bransfield had applied split-skin grafts to this area. When successful, these reduced contracture, but, as J. B. Brown pointed out, they were responsible for a foul odor caused by discharge pooling on the skin graft.

Some surgeons advocated freeing and posterior advancement of the nasal musoca of the hard palate. In 1957 Cronin in Houston developed a right-angle scalpel which he suggested be passed through the nose for division of the mucosa. Yet my experience with dissection of nasal mucosa from the hard palate is that it is blind and bloody and can be troublesome when the tissues are thin and begin to tear. Advancement posteriorly of the total nasal mucosa is not easy even in complete clefts where access is at least possible along the cleft. In incomplete clefts, where palate shortness is often of major concern, the dissection is still more difficult.

There are some surgeons who feel that attachment of a posterior pharyngeal flap to the velum brings about palatal lengthening. It would seem that any ultimate lengthening achieved when a routine pushback and a pharyngeal flap are used must be merely the result of a tug-of-war between the two raw contracting surfaces, one on the nasal side of the soft palate pulling anteriorly and the other on the underside of the pharyngeal flap pulling posteriorly. Surely two raw wrongs do not make a right, as evidenced by the pharyngeal flap tenting the posterior pharyngeal wall as a restricting synechia, dynamic or not, which anchors the velum and limits its freedom. Its primary advantage is that it succeeds in reducing the size of the velopharyngeal aperture; however, its unphysiological characteristics caused a continuation of the search for a more natural way to maintain lengthening in a pushback.

**MAKING AN ISLAND OF THE HUMP**

Recalling again and again the excess oral mucoperiosteum invariably humping up in the pushback flaps used by Brown and Byars, I finally decided to take the hump for a better purpose and to accomplish the shift by the island flap principle.
Repertorial Felix Freshwater, in 1978 a precocious plastic surgery resident at the University of Miami, in 1975 called attention to the little known fact that in 1831 Philippe Blandin of Paris seems to have been the first to conceive the island flap principle. He reconstructed a cancerous nose with a forehead flap which had the skin portion of its pedicle divided but retained its communication with the blood vessels and nerves and in 1836 pointed out that the use of this principle would reduce torsion.

In 1893 Theodore Durham of New York described a two-stage procedure which first transposed a skin flap of scalp to a face defect and later returned the skin pedicle but retained a permanent, buried vascular pedicle. Not until 1898 did George Howard Monks of Harvard Medical and Dental Schools independently describe the island flap in the Boston Medical and Surgical Journal. He was indeed a remarkable surgical pioneer, innovative and artistic, having been trained in anatomy by Oliver Wendell Holmes at Harvard and in sculpture by Ernst Hahnel in Dresden. Then, too, he had a touch of gamesmanship, having invented Halma (the Greek for leap), a game that became extremely popular throughout the world as the forerunner of Chinese checkers.

For a lower eyelid defect following excision of an epithelioma, Monks dissected the superficial temporal artery and veins as a stalk the length necessary to reach the eyelid, and then, for the termination of the unit, cut a crescent of hairless skin. He wrote:

I now had hanging from the region of the temple a long pedicle of subcutaneous tissue containing the artery, and attached to the end of it, a crescentic bit of tissue of the full thickness of the scalp and covered with skin.

Through a subcutaneous tunnel in a form of “Greek leap,” he passed the island through and sutured it into the eyelid defect, noting:

I had a little fear that it would slough for, even when it was in place, the strong pulsation across it from end to end was sufficiently reassuring.
In 1917 Esser described use of the island flap by means of the external maxillary artery.

The total efficiency of the island flap principle has always fascinated me. In Korea in 1955 I used it for eyebrow reconstruction, remarking:

In spite of the fact that in many clinics an aura of fear seems to hover above the "island flap," if Monks did it in 1898 and Esser in 1917, it deserved a try.

There is a generous blood supply to palatal mucoperiosteal flaps, not only from the descending palatine artery entering through the greater palatine foramen but by equally adequate subsidiary vessels, such as the ascending palatine and the palatine branch of the ascending pharyngeal artery, as well as branches from the tonsils and cheek. In fact, Dorrance, Wardill and Denis Browne all intentionally divided the posterior vascular bundles without endangering the mucoperiosteal flaps.

Thus it was conjectured that a greater neurovascular bundle could be dissected free from the underbelly of the main flap forward to an anterior portion of excess mucoperiosteum (the hump), which could be cut loose to dangle as an island.

The island flap was dissected out on cadaver palates without difficulty and was found not only to flip over with mucosa facing nasally but also to turn 90 degrees to fill and be sutured into the transverse releasing gap in the nasal lining. In fact, a preserved human hemi-head was carried about in the trunk of my car for many months to make possible an immediate scientific demonstration of the island flap should any student ask even the most haphazard question. Reactions varied from satisfaction to subliminal shock.

The first case was operated on September 12, 1960, at Jackson Memorial Hospital, Miami. The patient had an extremely wide cleft in a deficient palate that had had previous work in Illinois. The neurovascular bundle was dissected without difficulty and the mucoperiosteal island was cut free. For further mobilization, a block of the posterior bony wall of the foramen was resected with a chisel, as advocated by Limberg. The island flap turned as white as chalk. The neurovascular pedicle was massaged gently
and turned at various angles without color improvement. The prognosis was guarded, so I decided to place the island, not into the nasal defect out of sight as planned, but longitudinally in the oral closure of the cleft where it could be observed, the hope being that it would regain its vascularity and survive. It remained white, became necrotic and debrided itself, leaving a defect which healed by scarring. Then the patient, for economic reasons, returned to the Illinois area and has been followed by Sam Pruzansky.

MAKING THE LONG COUNT COUNT

It was the seventh round and Jack Dempsey's persistent punching had finally put Gene Tunney down. In the confusion, Dempsey was standing over him until the referee finally motioned him to his corner and started counting ten of the famous "14 count." There was Tunney on the canvas with a choice of lamenting his miserable position or figuring a way to get out of it. As pointed out by Mosey King, my boxing coach at Yale, Tunney took the famous long count to realize that Dempsey's left hooks were responsible for his plight and, when he rose, he had the sense to backpedal to his own left and away from Dempsey's vicious hook. This "thinking while down" retained for Tunney the World Heavyweight Championship and along with it, a check for 1,000,000 dollars.

This same principle has been of value to me several times when I have been "sitting on the canvas." While the blanched island flap was becoming necrotic, the idea of a palatal island was not condemned, but blame for its first failure was given, if not to injury and scarring from previous surgery, to arterial spasm following injury during ostectomy. The next island was soon maneuvered into the nasal defect and sutured without need for a bony foraminal resection, and the island retained its normal pink color at all times.

Once the method was mastered, it became almost routine. On one day at Kingston Public Hospital, Jamaica, three island flap palatal lengthenings were accomplished, and K.P.H. chief plastic surgeon Kenneth McNeill was impressed with the soundness of the approach and the relative ease of its execution. He later reported his experience with the method. We also noted a
smoother postoperative recovery after coverage of the nasal raw area, avoiding the usual discharge, discomfort and ultimate distortion.

In April 1961, at the meeting of the Southeastern Plastic Surgery Society held in Williamsburg, Virginia, this palatal island flap was first presented. The principle of the island flap with 14 successful cases was published under the title "Wide and/or Short Cleft Palate" in *Plastic and Reconstructive Surgery* in January 1962. The first illustrations of the technique showed the early islands to be small (1 to 2 by 2 to 3 cm.), as seen in a short incomplete cleft.

The same procedure was sketched again by Shirley Durkee in a complete cleft after first-stage closure of the anterior cleft with a vomer flap.

Previously inevitable contracture was now avoidable by the insertion into the gap of this stiff vascular island. With such a "filler" available, the nasal mucosa of the soft palate on either side of the cleft could be divided and pushed back more radically. An extra dividend was thus provided. Each soft palate half not only advanced posteriorly in the lengthening process but also shifted medially toward its mate across the cleft to be sutured with relative ease in the midline.
In 1963 in Surgery, Gynecology and Obstetrics, from the experience of 20 cases, I began to elaborate on the description of the flap in more detail:

All available mucoperiosteum is elevated from the hard palate in one flap for incomplete clefts and in two flaps for complete clefts. These flaps are peeled off the bone down to the posterior edge of the hard palate. The aponeurotic and mucosal attachments are divided along the edge of the hard palate which opens an elliptic gap in the nasal mucosa and allows the soft palate to advance toward the pharynx. On one side the greater palatine neurovascular bundle coming out of the greater palatine foramen is freed and dissected forward off the under belly of the mucoperiosteal flap with scalpel, scissors, and scaler. The required elliptic area of mucoperiosteum is taken from the anterior extremity of the flap, cut free and is left dangling on the neurovascular bundle. It can be turned over quite easily with its mucosa underneath and fixed into the nasal gap with No. 4-0 chromic catgut sutures.

The remaining portion of the pushback is routine and consists in Limberg's ostectomy, [partial or complete] bundle freeing on the opposite side plus bilateral hamular infraction, and posterior advancement and fixation of the mucoperiosteal flaps. The intact mucoperiosteal flap is brought across the midline slightly to offset the donor defect of the flap from which the island has been removed.

**LARGE BIPEDICLE ISLAND**

Most early island flaps were unilateral, being taken from one side and based on the neurovascular bundle of the same side. Yet by 1963 the value of bilateral neurovascular pedicles was realized as the double base allowed a larger island to be taken from the
mid-anterior position. The bilateral “bucket handle” approach was found of special value in incomplete clefts with extremely short halves, as well as in short palates following operations in which no primary lengthening had been attempted. The double-pedicle island was preceded by a standard Dorrance dissection of the mucoperiosteum.

This double-pedicle island can lengthen the soft palate one-half the antero-posterior length of the entire hard palate. It does, in fact, offer all the advantages and almost none of the disadvantages of the later-described use of bilateral total hard palate mucoperiosteal flap (sandwich) procedure.

**TWO ISLANDS FOR TWO PLANES**

An occasional palate cleft is so extremely wide that there is not enough tissue present to allow closure without such side-to-side tightness as to impede palate function. These are the cases in which speech obturators, tube pedicles and pharyngeal flaps have been advocated, none of them offering an ideal solution to the problem.

In 1966 in *Plastic and Reconstructive Surgery* the use of two island flaps was advocated, one for the usual nasal lining defect and the second to be introduced into the actual cleft on the oral side to reduce the side-to-side tension of direct closure. Division of the nasal mucosa from the posterior edge of the hard palate not only allows retropositioning but also facilitates medial advancement of the lateral elements a moderate amount. One island
will fill the pushback nasal gap. If the mucosal edges of the cleft are turned over, they can be joined for the nasal closure more easily in the midline, but the oral edges of the cleft are left gaping. The second island can be fitted into this defect to obtain closure without tension. The remaining mucoperiosteal flap ends are advanced posteriorly as they rotate together medially and are sutured over the nasal island and down to the edge of the hard palate. Of course, it is necessary to retain enough mucoperiosteum in the main flaps for adequate posterior advancement of 2\(\frac{1}{2}\) to 3 cm. on the oral side. Any mucoperiosteum anterior to this, once the hard palate cleft has been closed, can be considered expendable for island use. In only an occasional case, however, have two island flaps been required.

The first case of "two islands" is still the most exciting one. The patient was a pleasant, attractive 13\(\frac{1}{2}\)-year-old Cuban girl who had emigrated three years before to Miami. She had a small ventricular septal defect in addition to a severe unoperated cleft of the soft and posterior third of the hard palate. Examination in 1962 by the South Florida Cleft Palate Clinic revealed:
	not a great deal of tissue in the lateral palatal shelves and close to unintelligible speech, aided by grimacing with nares collapse.

She was subsequently seen by three qualified plastic surgeons who considered her unsuitable for surgical closure and recommended an obturator. Dr. George Balber, prosthodontist, agreed with these findings and expressed the opinion that, from previous experience with such wide clefts, an obturator offered the only chance for improved speech.
As this patient had excellent teeth in good occlusion, I was unwilling to condemn her to an obturator for the rest of her life. In spite of the expertly compiled evidence to the contrary, surgical closure was carried out on July 8, 1963. With the patient on prophylactic penicillin for her cardiac condition, two island flaps were developed, the nasal mucosa was divided along the hard palate for retropositioning and one of the islands was used to maintain this length. An attempt to approximate the palate halves caused such tension that a superiorly based pharyngeal flap, 1.2 cm. wide, was sutured into the entire extent of the soft palate cleft on the nasal side. The oral side was closed without undue transverse tension with the aid of the second island.

Evaluation by a speech therapist two months postoperatively revealed great improvement in speech but marked nasal emission of air and sound. Cinefluorographic examination showed a soft
palate with moderately good mobility making borderline contact with the posterior pharyngeal wall. The patient was enrolled in a weekly speech clinic at the University of Miami. It was reported in 1966:

The only functional detraction in the velopharyngeal mechanism seemed to be the tight synechia of the pharyngeal attachment. The purpose of the pharyngeal flap had been to supply lining tissue to ease closure on the nasal side so that those normal palate muscles present could function unimpeded. Thus, division of the synechia was contemplated. However, this was postponed and over the years its presence apparently has become acceptable.

When the postoperative patient entered the speech clinic in 1963 she had nasal emission on all fricative sounds and a pronounced facial grimace, constriction of the nares. After 3 months she could produce the "s" sound in the initial position without nasal emission of air and with reduced facial grimace. Eighteen months later she could use "s" in single words, phrases and, finally, in conversation. After 2 years of therapy the patient's articulation test revealed no errors, her fricative sounds had no nasal emission, her oral resonance improved and her facial grimaces had been virtually eliminated. Cinefluorographic analysis on December 21, 1965 revealed a palate of average length and thickness with good mobility. The palate consistently achieved velopharyngeal closure with the middle third of the soft palate making pharyngeal contact at the level of the hard palate. Discontinuance of speech therapy was recommended.

A dividend gained from the introduction of the island on the oral side has been the chance to follow up and study this flap under direct vision in its new habitat. It does not show evidence of contracture, it maintains its rugae and, in fact, it continues to look and act like the mucoperiosteum that it was and is.

In my original paper I had diagramed the common procedures used for lengthening the palate, indicating each method of dealing or not dealing with the nasal raw area. Inadvertently, I omitted a diagram of Cronin's hard palate nasal mucosal slide-back which stimulated a lovely letter from Cronin to the Editor. He noted that the author had included the V-Y, the Dorrance and the Gillies-Fry, but:

He ignores the use of the most obvious and natural source of coverage: namely, the mucosa from the floor of the nose, the use of which I described.
Cronin did acknowledge:

The island flap would seem to be a worthwhile addition to the armamentarium of the palate surgeon.

He then began his offensive:

However, obvious disadvantages are apparent. . . . As Brown has mentioned, skin grafts in this area may be a source of crusting and odor. It is possible that the mucoperiosteal flap, being covered with squamous epithelium, might also give rise to the same problem. The mucosal flaps from the floor of the nose are, of course, covered with ciliated epithelium and goblet or mucous cells, making the accumulation of crusts unlikely.

Although neither patients, parents, doctors nor nurses had noticed any foul odor associated with the island flap cases, not until five years later was I able to answer Cronin’s challenge. In 1967 as an R. W. Johnson Fellow, Ron Pigott of Bristol, with a nasendoscope, gazed down upon a number of our mucoperiosteal islands. Later, with J. F. Bensen and F. D. White, he reported a small collection of mucus over the area of the island but no evidence of crusting or foul odor.

When viewing the island flaps from above, Pigott also noticed that some of the islands showed slight humping. This was thought to be caused by a dead space with its hematoma—and scarring between the island and the covering mucoperiosteal flaps. Since then a through-and-through suture from the mucoperiosteal flaps has been used to pick up the island flap while carefully avoiding the main vessels.

**MENDING THE LEVATOR MUSCLES**

After 10 years’ experience with the island flap, attention was directed to the correction of the misplaced levator muscle fibers in conjunction with the use of the island. As I commented in 1970:

A pushback palate closure, augmented by an island flap, allows division of the abnormal anterior attachments of the *levator veli palatini* muscles and allows their retropositioning into a more nearly normal position. As noted by Hoopes *et al.*, “The broad closure obtained by the posterior displacement of the levator insertion is the consequence of the island flap procedure introduced by Millard.”

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Stimulated by Maytag Fellow Malcolm Deane of Bristol, I began, à la Braithwaite, to dissect the fanned-out levator muscle into two discrete muscle bundles. This dissection was done just before dividing the mucosa along the edge of the hard palate—to maintain a fixed point and thus facilitate that part of the surgery. The nasal mucosa was then cut along the posterior edge of the hard palate, allowing the entire soft palate to shift backward. Once freed from their anterior tethering, and developed into two bulky muscle bundles, the levator muscle stumps could be closed into an intact sling by direct suturing. The island flap was then inserted to ensure and maintain the retropositioning of muscle sling and soft palate. It was conjectured:

Certainly if direct levator suturing is used as an adjunct, in addition to the island flap for nasal mucosal lengthening, total palate function should be facilitated even further. Another 10 years will tell.

Nine of the 10 have passed as of 1979. . . .

**REDUCING THE FISTULA FORMATION**

The use of a portion of the mucoperiosteum as an island to line the nasal side reduces the available amount of cover for the oral side. Consequently an increase in anterior fistulae might be anticipated.

In the early island flaps, all possible mucoperiosteum was elevated from the hard palate to be used as the island—or in the V-Y advancement. Fistula complications were further com-
pounded by the absence of mucoperiosteum in the vicinity of the fistula, making secondary closure most difficult.

During the 1966 survey, the number of fistulae found was exceptionally high. The technique was therefore modified, and a triangle of mucoperiosteum was preserved in the midline anteriorly over the incisive foramen in incomplete clefts (A). A wider triangle was left over the area of the previous anterior cleft closure in the complete clefts (B). As experience with this method was gained, the reduction in fistulae was assured, partly because of the change in technique, partly because of better selection of cases.

Although far from an asset, it is of interest that the fistulae had absolutely no effect on the length of the palate or on the speech results. This finding may be explained by the small size of the fistulae and their far-anterior position. (In the usual V-Y palate procedure, fistulae are prone to occur more posteriorly—at the junction of the hard and soft palate, where Calnan considered the scarring to be partly responsible for loss of the length gained during the original V-Y pushback.)

A BENEFIT OF EXPERIENCE

After 200 island flaps over a 10-year period, the operation should be getting reasonably easy to execute, particularly as it has never been nearly as difficult as surgeons expect. In 1970 I stated, as encouragement:

The island flap part of the surgery is easy, as it is done under direct vision. Experience has reduced the time required; the average case with a palate closure, levator muscle dissections and nasal mucosal release with an island flap takes about 45 minutes. The percentage of the time used on the island flap seems worthwhile. (Scalpel dissection of a neurovascular bundle usually takes less than a minute, while division of the mucoperiosteum to free the island, and suturing it into the nasal defect, takes less than 10 minutes.)

SAFETY IN DISSECTING THE BUNDLE

Probably the most intimidating aspect of an island flap is the thought that it is necessary to dissect out the individual vessels.
No—this should not be a daredevil procedure! Cut so to leave a subcutaneous sleeve around the bundle for protection. This is quite an easy maneuver when dissecting the bundles under direct vision from the underbelly of the thick mucoperiosteal flap. Try not to buttonhole the main flap, but if you do, stitch it up.
33. Other Surgeons Accept The Island

H A G E

On July 16, 1959, during intermission at the Royal Opera House, Covent Garden, at the time of the Second International Congress held in London, I first had the honor of meeting the sage Jacobus Hage of Tilburg, the Netherlands. He had the unique aura of stoical courage and honorable loyalty about him which pervaded his entire life right to the bitter end, reminiscent of the original "Dutch boy" who held his finger in the hole in the dike to save his homeland from flooding.

In 1962, during one of his work trips to the Dutch West Indies, Hage consented to return home via Miami, and during his visit a palatal island flap was demonstrated. He agreed with the logic of the operation and in 1964 reported, from his Plastic and Jaw Department at St. Elizabeth Hospital, his own experience both in Archivum Chirurgicum Neerlandicum and at the Hamburg International Cleft Palate Congress. He presented an ingenious diagramatic cross-section series to demonstrate the island flap action and noted:

The technique as described in his articles, and the operation as I saw it performed by Millard himself, have entirely convinced me of the value of the method. . . . If lengthening procedures involve the oral side of the palate alone, no actual lengthening is obtained, since the velum also has a nasal lining that needs lengthening. Transection or merely mobilization of the nasal mucosa near the border of the hard palate does not seem to give any permanent results—not even after grafting . . . —due to subsequent con-
tracture. Filling the gap with a pedicle flap of the posterior pharyngeal wall seems to be a non-physiological procedure. Due to its excellent vascularity and its rigidity, the island flap gives permanent and stable velum lengthening.

For extra lengthening, Hage suggested:

I have occasionally employed two island flaps for nasal lining, placing one transversely behind the other to fill in the gap.

Hage closed the anterior palate at 6 to 12 weeks and, using a Dorrance or Wardill-Veau-V-Y procedure, divided the nasal mucosa and inserted one or two islands at 1 year. He placed great value in a positive suction test through one nostril, with the other closed, at the end of surgery to determine the passive closing capacity of the velar valve. Hage also recorded the gain in length by means of radiopaque tracers, not only a few days postoperatively but also after three months, and published diagrams of the results in 1966 in the British Journal of Plastic Surgery. Three examples are shown here.

He noted:

My early results in primary lengthening of cleft soft palate (with or without a cleft anterior to it) have been so satisfactory that it seems justified to give a preliminary report. Yet it will take a long time, and a large series before the final results can be evaluated in the form of improved speech, for speech is the main criterion for good soft palate surgery. Not only in wide primary cleft palates is Millard's island flap useful, it can also be indicated in primary lengthening of a cleft soft palate. However, Millard's flap has a definite place in secondary lengthening procedures of the velum. It is thought that the indication for such can be based on four considerations:
1. Direct inspection—if the velum is short but the mobility is good, then this lengthening procedure is indicated.

2. Speech evaluation—by a speech therapist who finds nasality and other imperfections due to incompetent velopharyngeal closure which in turn is due to a short, and not an immobile, velum.

3. X-ray examination—to confirm previous conclusions.

4. Intelligence test—some cases are incurable due to low intelligence and other mental insufficiency which an island will not greatly aid.

If the postoperative palate with poor speech checks out on all four tests, these seem to be the cases *par excellence* for secondary lengthening with an island flap. Hage concluded:

Although the use of a pharyngeal flap is thought to be less "physiological," there still seems to remain an indication for a pharyngoplasty, *e.g.*, in too short and/or badly moving soft palates.

In a personal letter to me in 1970, Hage suggested that the island flap possibly was not indicated during the primary surgery in the young child and should be reserved for secondary lengthening. At the time I disagreed with him, but time and Berkowitz have won out with me and I look back at Hage's warning with humility.

One of my last communications from friend Hage was in October 1971, when he wrote:

Untreatment of cleft palates would give 100% of nasality in speech.

Primary closure of the palate now-a-days gives 70% or 70% good speech.

A secondary operation again will cure 70% or 70% of these unacceptable speeches. The residue of less than 10% can be satisfactory but is still a challenge for the future.
WITH PEET

During a 1965 International Congress in Bratislava, a mutual friend, Czechoslovakian professor Stefan Demjen, organized, in his clinic behind the Iron Curtain, a true Anglo-American cooperation. A patient with a short cleft palate was anesthetized, gagged and marked for an island flap. Then Eric Peet executed the Oxford V-Y technique in his usual impeccable style. Once his dissection was completed, he moved over to allow me to prepare the neurovascular bundle, cut the island free, release the nasal mucosa from the hard palate to obtain the desired lengthening and insert the island flap. Peet completed the suturing of the cleft. I could see he was pleased with the result of our teamwork and asked him his opinion. He admitted:

The island flap is a good idea and no doubt will be found of value, particularly in short incomplete clefts where our percentage of good speech results has been less.

AN ENTHUSIASTIC SWITCH

On September 28, 1961, before the American Society of Plastic and Reconstructive Surgeons in New Orleans, M. T. Edgerton presented a paper entitled "Surgical Lengthening of the Cleft Palate by Dissection of the Neurovascular Bundle." Under the subtitle "Palatoplasty techniques to lengthen mucosa on the nasal surface of the palate," he laboriously outlined everything he had been able to find in the literature by anyone or think up on his own. This was published in Plastic and Reconstructive Surgery in May 1962, where he again itemized the various nasal lengthening possibilities:

1. Undermining and advancement of nasal cavity mucosa
2. Anterior or midpalatal relaxing incisions in nasal floor
3. Lining epithelial inlays grafts
4. Z-plasty of margins of nasal mucosa
5. Vomer flaps
6. Anterior obturators with deliberate fistula
7. Extraoral or buccal mucosal flaps
Absolutely no mention of the mucoperiosteal island flap was made although the method had been presented by me 14 months before and published five months previously. Edgerton explained that, in over 500 palatoplasties at the Johns Hopkins Hospital since 1947,

we have employed various combinations of pushback operation.

He concluded by advocating sharp dissection of the neurovascular bundles and added:

Of course, [it] may be combined effectively with Z-plasty of the nasal mucous membrane and various types of elongation techniques of the palatal flaps themselves.

At the 1961 New Orleans meeting I approached Edgerton after his paper and told him of the island flap design:

Milt, you are close but not quite there. All you have to do is cut an island off, leaving it attached to the freed neurovascular bundle and use this piece of mucoperiosteum to lengthen the nasal side.

He admitted that it sounded like a good idea and promised to try it. He later asked if it were possible to cross the midline with the island.

On August 24, 1962, I wrote encouraging him again to try the island:

Dear Milt:

. . . What I am really writing you for is to encourage your use of the island flap. The more I use it the happier I am with the pushback results and in the hands of a surgeon as skillful as yourself, it would receive its ultimate effect.

His letter of December 12, 1962, in response indicated that finally he had followed the suggestion:

Dear Ralph:

. . . I have followed your suggestion on two or three occasions and found it really useful.
Dr. D. Ralph Millard, Jr.
2121 Biscayne Boulevard
Miami 37, Florida

Dear Ralph:

Thank you for note calling attention to the problem of the septum for closure of a defect in children with cleft palates. Am glad to hear you continue to like the island flap with pushback surgery. I have followed your suggestion on two or three occasions and found it really useful. Incidentally, would you be good enough to send me a couple of copies of your various publications on cleft lip and palate surgery for use in the plastic library. By the way, I enjoyed your description of your visit to the West Indies very much.

Sincerely yours,

Milton T. Edgerton, M. D.

A last letter to Edgerton:

Dear Milt:

Thank you for your letter and I am pleased that you have found the island flap useful. I can now answer a question you posed to me last June. Several days ago, I did a secondary pushback on an incomplete palate which had been closed many years before. I took the mucoperiosteal flap from the anterior portion of the flap crossing the midline for about one-third of its size. There was a scar across the island. There was no difference in the color of the island and there was a bleeding edge distal to the scar. There has been no difficulty with the flap as far as I can tell since the operation and therefore, although this is only one example, it indicates that you can take a flap with at least a portion of it across the midline.

Then Edgerton in 1965, writing in the December Plastic and Reconstructive Surgery:

Over the past 5 years, the Plastic Service at Johns Hopkins Hospital has employed two surgical operations for obtaining velopharyngeal closure in patients with defective palates. . . . One of these operations (the island flap push-back) is being used with increasing frequency by the author for all types of congenital clefts.
He represented the technique of the island flap used in the usual nasal lengthening, offering nothing new except lovely drawings by the Johns Hopkins University artist.

The absurdity of this 1965 claim is highlighted by the facts presented. Two days after Christmas 1965, when I first read his article in the December Plastic and Reconstructive Surgery, I flew to Philadelphia, took the train to Harrisburg and spent several hours with Dr. Ivy going over my records and correspondence. A stopover in Philadelphia gave me a chance to repeat the discussion with Peter Randall. Later gentle Ivy advised that, rather than publish my (scorching) Letter to the Editor, it would be better to have Edgerton write a letter of apology. His belated acknowledgment in 1966, ending with "the credit for the first description of this technique belongs to Dr. Ralph Millard," never quite covered the issue as there was never any question of priority. His retrograde inference of independent conception of an island for nasal lengthening is disclaimed. Independent conception can and often does happen to all of us, but in this instance, it so happens that the records disprove the claim.

VILAR-SANCHO ALTET

The vigorous Beneto Vilar-Sancho Altet of Madrid, Spain, spends several months each year in submarine archeology, exploring shipwrecks on the bottom of the Mediterranean Sea, diving from Ibiza, the smallest of the Balearic Islands. He has reclaimed from the sea parts of hulls, anchors and many double-handled am-

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phorae from the ruins of Roman and Carthaginian ships dating back as far as the second century B.C. His wife, Pilar, always dives with him so, as he says, “to stand guard against the sirens.” This off-island diving has kept him in shape to do a multitude of Spanish palatal island flaps. His first publication in 1966 varied the design by leaving a large triangle of mucoperiosteum anteriorly over the incisive foramen and cutting off one entire palate mucoperiosteal flap as the island, instead of using the lopsided V-Y posterior advancement. He presented a movie on the island flap in 1967 during the International Congress in Rome.

In 1971 Vilar-Sancho wrote:

We have carved out about 175 island flaps of which about half were in secondary palate repairs.

What we like best about this operation is how easy it is to carry out, the considerable lengthening obtained, together with the versatility of the use of this island flap.

What we like least is the possibility, although remote, of losing the island flap, which leaves us a very difficult problem to solve.

**DIJKSTRA**

R. Dijkstra of Zwolle, a cross-country skater and a trainee of Hage, in 1969 wrote in the *British Journal of Plastic Surgery* of using an island flap as a secondary lengthening maneuver. He suggested calling the procedure a “release” rather than a “push-back,” and his diagrams demonstrated use of unipedicle and bipedicle islands. He reported:

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The lengthening achieved was found to be permanent in the majority of cases, but the effective lengthening was limited to a maximum of approximately 10 mm.

It was Dijkstra’s impression that the results were better than those previously obtained with simple pharyngeal flaps . . . [but] the method is not universally applicable. . . . Lengthening is obviously of no avail in the paralysed palate, and probably not in the congenitally short palate. Also island flaps are not advisable in the badly scarred and collapsed hard palate, for technical reasons.

In 1977 Dijkstra stated that he no longer uses the island flap, preferring the superiorly based pharyngeal flap advanced so the tip closes the nasal defect. He outlined his reasons:

1. I consider the pharyngeal wall a more expendable donor site than the palatal vault.
2. The operation is easier to perform.
3. Apart from the palatal lengthening (which I agree is essential), this operation provides for a certain narrowing of the pharynx.
4. The island-sandwich is rather bulky and often seems to effect some descent of the palate.

GEORGIADE

We had the pleasure of Nick Georgiade’s company on one of our Jamaican work trips in the middle 60’s, during which several island flaps were used. Since then, in 1969, Georgiade, Mladick, Thorne and Massengill reported preliminary evaluation of the island flap in cleft palate repair. They used bilateral neurovascular bundles in incomplete clefts.

In complete clefts, they used a unilateral pedicle, dividing a large mucoperiosteal island at an angle which did not allow V-Y retropositioning on the oral side and thus might conceivably have reduced the possible overall lengthening. They particularly mentioned leaving a nasal mucosal cuff (arrows) along the edge of the hard palate to facilitate suturing the island flap. They made several other salient points:

In our experience, the intact untraumatized bundle provides excellent vascularization for even the largest of the island flaps. The firmness of the island helps support the repair and gives a two-layer overlapping closure in
the area of maximum tensions. . . . We have found some definite limitations with this procedure. In clefts with narrow arches and/or wide complete clefts, it is difficult to get a sufficiently wide island flap. Without a large island flap the pushback effect is limited. The width of the island flap determines the extent of the pushback and, unfortunately, no matter how long the island is made, its width is predetermined by the distance from the alveolar ridge to the cleft. The operation takes approximately thirty minutes longer than a simple pushback. In a few adult cases we have found extensive arborization of the neurovascular bundle which hinders mobilization of the vessels. In one adult case, there was a portion of a flap that was definitely compromised, possibly because of the division of the many branches during mobilization.

REICHERT

In 1969 Heinz Reichert of Stuttgart wrote:

Finally, in the palate, by using flatter and wider pieces of bone graft, we have been able to obtain a smooth vault and avoid affecting later growth. Collapse in the premolar and molar region no longer occurs. Both secondary closure of the soft palate at 3½-4 years and also later palate lengthening by Millard’s island flap in short palates are made considerably easier by the existence of an intact bony palate.

MARCHAC

The suave and talented Daniel Marchac of the Children’s Hospital, Paris, was a Maytag Fellow in Miami in 1966. In 1970, in Vie Médicale, he outlined the various procedures being used to augment the velopharyngeal sphincter. In this paper he expressed his
approval of the island flap in primary and secondary velar lengthening. His diagrams of the secondary procedure are of interest.

During a 1977 visit to Miami, he confirmed his continued use of the island flap principle in secondary cases.

**Takahashi**

In 1970 the energetic Shojiro Takahashi of the Tokyo Dental College, who had also observed the island flap pushback procedure in Miami, published in the *Japanese Journal of Oral Surgery* a complete cross-section list of palate-lengthening procedures and, I am relieved to say, in Japanese diplomacy at its best, included the Cronin method. His diagrams of his rendition of the island flap lengthening were presented.
In 1972 he kindly forwarded me photographs of his use of the island flap nasal lining during a pushback, showing (1) nasal lining defect after release, (2) dissection of neurovascular bundles, (3) island flap, (4) completed operation.

In 1977 he wrote:

The island flap method is excellent, but it leaves rather large raw surfaces in the hard palate. I have used the island flap method in about thirty cases. Recently we have been using it on wide or short cleft palate, and in adult patients.

NOORDHOFF

In 1970, in *Plastic and Reconstructive Surgery*, M. Samuel Noordhoff of Taipei, Taiwan, reported successful treatment of five difficult secondary palate cases which had had previous surgical procedures resulting in complete or partial dehiscence, scarring, velopharyngeal incompetence and unintelligible speech. He combined a pushback procedure with an island flap and a pharyngeal flap. Elevating two mucoperiosteal flaps, he took an elliptical island from the lateral aspect of the better one. Freeing the soft palate from the hard palate by dividing the nasal mucosa and scar presented a defect into which he turned the island flap.
The island was attached to the edge of the hard palate by sutures through drill holes.

In 1977 Noordhoff reaffirmed:

The island pedicle flap is extremely useful in severely scarred, short, tight palates where previous surgery has resulted in a cleft palate disaster. In these cases I use a push-back palatoplasty with island pedicle flap and inferiorly based pharyngeal flap. The island pedicle flap allows a release of the tight, scarred palate posteriorly. An effective release is not possible by a simple push-back procedure and the island pedicle provides the means to do it. These patients need 1 to 2 years before they can develop normal speech. Blood loss is frequently severe. The results have been extremely encouraging. This week a 1½ year postoperative patient came in who has developed normal speech from unintelligibility. I do not have statistics on this as we are in the process of calling in old patients.

To relieve side-to-side tension in closure of the soft palate, Noordhoff followed my suggestion of turning up the edges of the cleft for oral closure and introduced a superiorly based pharyngeal flap for nasal closure in four of the cases. His conclusions were logical:

Changing lines of stress from scar contractures is a consideration in all aspects of plastic surgery—an example being the Z-plasty. Such a concept is also applicable in scarred palates. The release of scar contracture posterior to the palatine bone, with interpositioning of the mucoperiosteal island flap, changes the direction of the lines of tension—possibly resulting in gradual reabsorption of collagen and softening of the palate. The pharyngeal flap contributes to decreased lateral tension, as well as narrowing the velopharyngeal space.

The softening and increased mobility of the palate seem to take a considerable amount of time—at least one year. The improvement in speech is gradual in these patients. . . . The combined operation used in these is not recommended for all secondary operations for velopharyngeal incompetence. More simple procedures, such as the pharyngeal flap, may be all that is indicated when there is good palate mobility and lateral movement.

**H O O P E S**

John E. Hoopes of Johns Hopkins Hospital, Baltimore, has been using the island flap to line the nasal side of the pushback
operation since 1965. These are diagrams of his rendition of the island flap.

Convinced of the importance in speech results of the final position of the levator sling postoperatively, Hoopes wrote me in 1977:

It has been my feeling that the island flap pushback palatoplasty is the only procedure which results in significant retro-displacement of the levator sling. I have, therefore, in my personal series utilized (almost exclusively) the island flap pushback for repair of cleft palate. Needless to say, I was distressed by the data in the recent paper published by Drs. Luce, McClinton, and myself. It is imperative now that I extract from the data those island flap pushback procedures performed only by myself—in that I, personally, have had no postoperative fistulae, and my patients have not (inordinately) required secondary pharyngeal flaps. In spite of the data, I continue to utilize the island flap pushback—simply because I have no other procedure available to me which significantly retro-displaces the levator sling.

I must admit that Hoopes' reasoning seems sound, and any further data he uproots will be of interest.
DAVIES

David Davies of Capetown, South Africa, since 1964 has resorted to total closure of the entire cleft of the lip, alveolus, hard and soft palate in one stage at about 3½ months. In 1971 he noted:

The lip is repaired with a Z-plasty, the alveolar defect [bone] grafted, and an extensive pushback done with the use of a Millard island flap.

He has the impression that the longer, more mobile palate is giving better speech results. He does not agree with orthodontists' objections to an island flap causing a large raw area and the resultant scarring causing collapse. The raw area epithelializes for him in two to three weeks. No decrease in vault space has been noted in any of the cases.

Since 1973 H. Wolfgang Løsken of Pietermaritzburg, South Africa, trained by Davies in Capetown and as a Maytag Fellow in Miami, has also been carrying out the total cleft closure according to the Davies plan, including the island flap. His one improvement is the use of the rotation-advancement lip closure.

"SANDWICH" FLAPS

In 1967, in the British Journal of Oral Surgery, F. T. Moore and J. Kenneth Chong of Queen Victoria Hospital, East Grinstead, Sussex, England, noted, much as I had five years before, the
consequences of dividing the nasal mucosa during the Veau-Wardill V-Y retropositioning of the palate.

The raw area on the nasal aspect of the junction of the hard and soft palate heals by secondary intention, scars and contracts as it heals, thereby reducing the gain in length of the soft palate to negligible proportions.

They presented their modification of the island flap principle and dismissed my previous work (1962, 1963) as "small elliptical island flaps taken from the anterior hard palate." Moore and Chong advocated taking almost the entire mucoperiosteum on each side based on a neurovascular bundle. After dividing the soft palate from the hard palate by a through-and-through incision, they inserted the two islands into the defect in double-decker style, one for nasal lining and the other for oral cover. Likening this to a "sandwich," they predicted permanent lengthening equal to half the maximal width of the hard palate. They reported 40 such cases "with 8 requiring Moore’s lateral pharyngoplasty" in addition.

Actually, my first paper in 1962 described small flaps, but the paper in 1963 showed the anterior half of the hard palate being carried on bilateral bundles, which maneuver gets every bit as much into the lining as the straight sandwich. In 1966 I described two larger flaps, one placed transversely in the nasal side and one longitudinally in the oral side—"double-decker" in
principle as a crisscrossed "sandwich." This approach actually, in
addition to nasal lengthening, achieved side-to-side release not
possible with the straight sandwich.

In 1973 J. P. Bennett, while still at the Queen Victoria
Hospital, reported a follow-up on F. T. Moore’s cases and the
present procedure at East Grinstead:

The sandwich pushback is the first procedure wherever possible. If, after an
adequate period of speech therapy, nasal escape is still present and further
improvement from surgery can be expected, a lateral pharyngoplasty is
carried out. Only a few patients do not achieve normal, or at least accepta-
ble, speech following these two procedures and in such cases, it has been
recently found that a Rosenthal pharyngoplasty can produce further im-
provement.

Out of 80 patients reviewed, 42 had gained normal or accept-
able speech. Of the 33 cleft palate patients treated by sandwich
pushback and lateral pharyngoplasty, 17 had achieved normal or
acceptable speech. Of 6 patients treated by all three operations, 3
had achieved normal speech.

Of special interest were 25 patients suffering from suprabulbar
paresis, out of which 14 achieved normal or acceptable speech.
More important may be the fact that the troublesome problem of
dribbling saliva in these patients was relieved following the
sandwich pushback, probably because the palate lengthening
improved the act of swallowing.

J. Kenneth Chong, born in Malaysia, was trained in medicine
at Oxford University and St. Bartholomew’s Hospital, London,
and in plastic surgery at East Grinstead. In spite of having
suffered burns of his hands, treated with skin grafts, he has
superior manual dexterity. Like a bumblebee carrying pollen from
garden to garden, Chong, after his flight from Sussex to Penn-
sylvania in 1967, soon had the "sandwich" blossoming in Phila-
delphia. In 1973 Culf, Chong and Cramer of Temple University
presented the method at the Duke Cleft Palate Symposium,
noting:

The most ideal situation for this type of operation was in those patients who
demonstrated a short but mobile and supple soft palate without significant
scarring and a velopharyngeal defect of less than 1 cm. The relative width
and length of the hard palate was a decisive factor in determining whether this particular procedure would be carried out. If the hard palate was narrow, either because of scarring, a particular patient’s anatomy, or previous incisions in less than ideal positions... another type of operation would be done... As one can see from these criteria, the ideal candidates were those with submucous clefts or patients who had had previous palatoplasty with short mobile, minimally scarred palates and hypernasal speech.

Specific details of their rendition of the double-decker sandwich island flaps are of interest:

They are designed so that the lateral incision is made 2 to 3 mm. from the dental-gingival margin, and, on making the medial incision, a 3 mm. midline mucoperiosteal strip is left in situ. This medial strip serves two purposes. It decreases the possibility of reopening of the previously repaired cleft. Second, it assists with closure of the flap donor site by proliferation of mucosal cells.

The island flaps are developed as described often before, but these authors seem to feel the need for extra freedom:

An ostectomy of the posterior medial portion of the canal is then done to allow retrodisplacement and mobility of the neurovascular bundle. After the ostectomy, further gentle mobilization of the vessels is carried out so that in changing the axis of the flap from longitudinal to a transverse one, the pedicle will not kink.
Of course, it is the unnecessarily wide, blunt, distal end of their island and the short stalk of their bundle that makes this maneuver awkward and difficult, requiring foraminal ostectomy. Even the three C's admit danger with ostectomy, a danger I experienced in my first case. They warn:

It is usually preferable to do the ostectomy prior to making the posterior cut (between the hard and soft palate), so that if the vessel is injured in this maneuver, a different plan can be carried out.

They then extend their posterior incision across the central intact strip and, gaining control of the nasal mucosa with sutures, make a through-and-through incision dividing the soft palate from the hard palate about 3 mm. posterior to the bony edge. They noted:

It is important to carry this incision well laterally to ensure complete transection of the levator aponeurosis and nasal mucosa. The dissection is then continued laterally and posteriorly, including the insertion of the tensor palatini if necessary. Blunt dissection progresses until the soft palate has been adequately pushed back and stays there without traction. Therefore the width of the island flaps should be equal to the width of the defect.
One island flap is flipped over and transposed as nasal lining, and the second island flap is transposed over it as oral cover.

Culf, Chong and Cramer presented the combination of double hemi-palatal island flaps and a wide superiorly based pharyngeal flap. The distal end of the pharyngeal flap was denuded of mucosa and threaded through a submucosal tunnel in the velum. Lateral ports were ensured with No. 8 FG catheters.
They also noted the possibility of combining one hemi-palatal flap with a cheek island flap when the double palate islands were not available.

Robert B. Winslow, trained in island flaps at Temple University by Cramer and Chong, reported in 1974, with Bradley, Warren and Bevin of the University of North Carolina:

Bilateral island “sandwich” flap combined with a superiorly-based pharyngeal flap is an operation designed to restore V P competence. The efficacy of this operation was determined by measurements of V P competence and these results were correlated with observed speech changes. It appears that this operation is safe and reliable as a means of reducing V P sphincter size, restoring V P competence, and favorably modifying the associated articulation-voice quality problems.

They made some comments about the island on the oral side which could be observed postoperatively:

Although we cannot supply documentation now, in every case we have noted an increase in the length of the palate during the postoperative recovery period. It appears that what was originally an elliptical island in the soft palate slowly becomes circular or even rhomboidal. The long axis (transverse) shortens and the short axis (antero-posterior) increases. Theoretically, this may be due to scar contraction with the longer scar contracting more and forcing the “islands” to change their shape in a manner that lengthens the palate. In addition, contraction of the pharyngeal flap might “pull” the palate posteriorly.
AN EMPTY SANDWICH?

The sandwich principle, although it offers permanent lengthening, is probably overrated. First, it takes almost all the mucoperiosteum covering the hard palate, a loss that in the young, growing patient cannot be tolerated. In the adult, there should be no trouble. Two elliptical flaps—and they should be elliptical to fit the defect and not blunt-ended—one on top of the other, will interrupt the scar contracture, but with far more scarring. I much prefer to take the anterior half of the mucoperiosteum on bilateral bundles, which gives as big a flap for the nasal lining release, and, without cutting a second island, merely slide backward the intact distal half of the mucoperiosteum and attach it to the edge of the hard palate. Remember, the transverse release of the soft palate from the hard palate must stop at the most lateral edge of the hard palate on each side; thus the amount of possible pushback is limited. The attainable amount of pushback can be achieved just as well with the bipedicile island, or a simple larger island as with the sandwich and with less double-decker theatrics and scarring in its wake.

OTHER OPINIONS

Many surgeons favoring other techniques have noted the value of the island flap. In 1972 David Sullivan of Spokane, who uses the two lateral pharyngeal flaps, did admit:

I have found your turned-over island flap of palate mucoperiosteum most helpful in closing the defect on the nasal aspect.

Hector Marino of Buenos Aires wrote in 1972:

As for the island flap, I must say that I was the first to demonstrate it in Buenos Aires, during surgical sessions held in the Instituto de Quemados for the Latin American Congress. I am totally pro it as it is the soundest method to prevent the nasal contraction of the pushed palate. Besides, the dissection of the palatine arteries has ended all the trouble caused by the stretching of them or the Limberg demolition of the canal. The only drawback in my particular case is that, as I have the doubtful privilege of operating many secondary cases, I have seldom an unscarred mucoperios-
Sebastian Rosasco of Buenos Aires wrote in 1976:

We would like to clarify that the number of island flaps operated by us is 162. Our results have been very satisfactory; we have applied your island flap procedure, together with the mobilization of other flaps, in one step, as shown in the diagrams of a complete cleft.

We consider of real importance: (a) the closing in one step because it reduces the percentage of wound disruptions, and (b) at an early age, 18-24 months old, because of difficulties with closure, plus the pathological speech patterns are more difficult to correct when closure is performed at an older age. However, our enthusiasm has been diminished recently by a publication of Ralph Blocksma. . . . They have observed that this trouble of the development of the maxillae is evident in the 10 years follow-up, and is common to other procedures that dissect the mucoperiosteum of the hard palate. . . . Have you had trouble with the developing of the maxillae in follow-up of more than 10 years? At what age have you done the dissection of larger mucoperiosteal flaps of the hard palate?

In 1974 Demjen wrote:

In Millard’s island flap procedure, . . . the posterior flaps or flap remain without benefit of blood and nerve supply from the posterior neurovascular bundle. This procedure is gaining popularity around the world. Yet there were no reports of complications in healing or necrosis of the posterior flaps and no observations of atrophy of the soft palate or disturbance of the growth of the maxilla attributable to this step of the surgical procedure.
In 1974 in the President’s Address at the meeting of the Royal Society of Medicine, F. L. F. Innes of Norwich expressed enthusiastic approval of the island flap in lengthening the palate during a pushback operation. In the 1976 Proceedings he stated:

The Kilner-Wardill operation on the palate does not elongate the palate very much because the nasal mucoperiosteum does not stretch sufficiently. . . . Division of the nasal layer without filling in the gap is no answer because of the high incidence of breakdown of the repair with a one-layer closure and because of the scarring which inevitably occurs on the exposed nasal surface of the buccal flaps, impeding the movements of the palate as well as causing shortening. A brilliant solution to this problem has been presented to us by Ralph Millard (1963). The Millard island flap is a triangular piece of mucoperiosteum, isolated from the anterior end of one of the “V” flaps of the Kilner-Wardill operation except for its stalk of posterior palatine vessels. This very mobile piece of tissue can be turned over easily, with its epithelial surface uppermost, into the gap after dividing the nasal layer. It elongates the soft palate in a most remarkable fashion. The Millard island flap is in my opinion the greatest advance of recent times in the surgery of the cleft palate. I have used this flap occasionally in the primary repair operation performed at the age of one year, when it looked as if the soft palate would be grossly deficient, but it need not be introduced as a routine in the primary operation for the simple reason that the Kilner-Wardill operation itself is sufficient. The Millard island flap is, however, the greatest possible assistance when the soft palate is deficient, as it is, for example, in the submucous cleft palate. The procedure is in my experience without any faults. It is safe and efficient, and it is an elegant application of the principles of plastic surgery. The division of the nasal layer should be radical, carried well out to each side, and the Millard island should be of generous dimensions so as to fill the gap without tension. . . . For some time, I have been doing the two procedures—the Millard island flap and the Hynes pharyngoplasty—at the same operation and I can recommend the combined procedure with confidence as perfectly feasible. It has produced results which are far better than I have previously obtained. . . . If the Millard island flap operation on the palate and the Hynes pharyngoplasty are to succeed there must of course be unimpaired movements of both the palate and the pharyngeal wall. If the movements are deficient, the result of surgery will be less than hoped for. . . . Both procedures appeal to me because they enhance the mechanism of closure of the isthmus in a natural fashion. Pharyngeal flap operations, whether based above or below, are unnatural. To have to use them is, in my opinion, an admission of defeat. I do, however, perform a
pharyngeal flap operation if I am confronted with a palate which does not move properly or if the combined operation which I have mentioned fails, as it does occasionally, to provide an efficient mechanism. Most of my failures are due to poor or inconsistent palatal elevation. For these cases one must accept that the palate has to be tethered to the pharynx by a pharyngeal flap.

STELLMACH

At the Sixth International Congress held in Paris in 1975, Rudolf Stellmach of Berlin stated:

There is no problem to lengthen the oral side by the use of the V-Y technique and setback of the pedicle flaps. But it is rather difficult to lengthen the nasal side as much. Most promising so far is the dissection of nasal pedicle flaps according to Cronin or the use of the island flap proposed by Millard.

RINTALA

Aarne Rintala of the Finnish Red Cross Hospital, Helsinki, wrote in 1976:

The diagram of our modification possibly needs some explanation. The pushback is achieved by a transverse incision and the island is inserted on the nasal side as big as possible. On the donor area, between this and the other flap to the oral side, we leave a narrow strip of oral mucosa attached to the periosseum reaching down to the border between the hard and soft palate. The flap to the oral side to cover the nasal flap is cut as big as possible, even bigger than the first one, and rotated down to cover the defect in the soft palate. In this way, I am trying to put the most tension transversely in order to avoid secondary shrinkage of the lengthened soft palate. The anterior middle edge of this oral flap is sutured tightly with one stitch to the narrow mucoperiosteal strip left in place in the midline of the hard palate. This is done because otherwise the edge of the oral flap will have a tendency to protrude downwards into the mouth as a hanging flap, probably because of its size and the rotation.

As far as I can remember, we have not lost a single flap. Neither can I remember now any other major complications. The method has been very successful in closing fistulas, in these rare cases where it has been used. The primary lengthening of the palate has been on the average 10–15 mm. There has been some secondary shrinkage, but not very much. It looks like the palate would be permanently lengthened in practically every case.
In 1977 in Toronto, at the Third International Congress, Aarne E. Rintala and S. L. Rantala reported having used their modified island flap operation on 57 secondary palate cases (4 to 27 years of age) with persistent nasality and unsatisfactory speech with a nasopharyngeal gap not exceeding 12 mm. at phonation, as estimated by lateral radiography. Results: 90 percent achieved 1 cm. or more length. There was noticeable decrease in nasality in 68 percent with no change in 30 percent. Lateral radiography in phonation of sss revealed lengthening of the palate in 63 percent. The authors noted:

Preoperatively no velopharyngeal closure could be observed in any of the patients. Postoperatively definite, or probable but not constant closure was detected in over 50 percent. The general quality of spontaneous speech was estimated good in 58 percent, and there was considerable improvement in 51 percent. . . . Summarizing, the island flap as a secondary procedure seems to improve the speech in a majority of patients, but relatively seldom results in complete disappearance of nasality, and fully normal speech. . . . Probably the island flap as a secondary procedure should be reserved to selected cases with a tight but mobile velum, slight nasality and a nasopharyngeal gap not exceeding 5 mm. at phonation. An advantage of the method is that it is no "final" operation, and if the result should not be satisfactory, a pharyngeal flap can still improve speech.

MAISELS

In 1976, more than 10 years after he had been a Maytag Fellow in Miami, the sound David Maisels wrote of his interim experience with the island flap. He had assisted me on numerous cases in which this technique was used and therefore I was interested in his report.

I employ the fairly standard V to Y pushback with Veau flaps. When I first returned from Miami, I was using an island flap virtually routinely in all cases, but as time has gone on, I find myself doing so less frequently. I think the main reason for this was that I had one or two cases in whom I got such a marked pushback that the anterior palate repair was left unsupported by an oral layer, and in one case I had a fistula here, which of course was not very easy to repair, because most of the good tissue had been pushed back. I have found that as I become more radical in my deep pterygoid dissections and hamular fractures, as outlined by Braithwaite, there are fewer and fewer cases
in which I am forced to use an island at the primary operation. I still use it from time to time in secondary repairs in order to obtain more length and in those primary cases with the typical V-shaped cleft where I just cannot get a decent closure by the standard methods.

FURNAS

David Furnas of the University of California in Irvine is an articulate, humorous and ingenious surgeon who received some of his early training with Conway where pharyngeal flaps were popular. Nevertheless, I gambled on his versatility and asked him if he had any experience with the island flap. As he has a clever way with words, they are included verbatim:

I have had some experience with palate lengthening with your island flaps, and feel that it is an elegant procedure. My experience has diminished in recent years because I have been doing primary pharyngeal flaps at the time of my palate repair. . . . An island flap dramatically rescued me in a patient several years ago. I was supervising Harlan Wald, and the case was a primary pharyngeal flap in a one-year-old child. When the flap was sutured into place, the suture line showed unmistakable signs of tension. Despite much discussion, cogent comments on how wounds relax as they remodel, and assurances from the first-year resident that everything would be all right (particularly his weary ischii), the tension was unchanged after ten minutes of collagen remodeling. Then the elegant maneuvers of the island flap came to mind (much like the coconut palms of a Pacific atoll might heave into view of a drifting, shipwrecked seaman). In a few minutes the island was in place, serving as a bridge between the posterior nasal layer of the palate, and the anterior layer of the pharyngeal flap. The tension in the flap, and the operating room, was completely dispelled. The patient has perfect toddler's speech now.

PERSONAL OBSERVERS

Palate surgeons have not yet taken to the island flap as much as I would have hoped. There seems to be an inherent hesitancy to attempt to dissect an island. It evidently is a "see one, do one" procedure, for most surgeons who have observed the operation are pleased with the ease of execution and return home to use the procedure. Of course, only those who have observed firsthand the
use of an island flap in a pushback operation are in a position to give a clear opinion of the approach. Thus comments from surgeons who have been invited to observe one or two examples of the surgery are pertinent. Hage, Takahashi, Georgiade, Maisels and Marchac have watched and then gone on to do the procedure routinely. A very special guest to observe the island flap was Robert H. Ivy.

Ever since Ivy, as editor, accepted my first rather atypical paper, "Plastic Peregrinations," for publication in Plastic and Reconstructive Surgery, we had been friends. In his later retired years, he accepted several visiting professorships at the University of Miami, and in 1972, during one of these, he was invited to observe an island flap pushback. This is a simple procedure often accomplished in 45 minutes. After the surgery we went over to the adjacent blackboard to diagram in review the specific steps taken in that case. Then I turned to Ivy, who although humble, unassuming, diplomatic and extremely knowledgeable was above all else honest, and asked him what he thought of the operation. He answered in typical, straightforward, simple prose:

The best thing you could do. . . . Got it all over the pharyngeal flap in my opinion.

Peter Holm of Copenhagen, after observing an island flap pushback operation on May 17, 1974 stated:

Most plastic surgeons doing palate surgery claim they do a pushback operation—I have seen a lot of palate surgery but no pushback until today, my own surgery included. So much about the pushback itself—another question is how often a pushback is needed.

THE DIEFFENBACHS

With his father professor of philosophy at Königsberg and his mother the daughter of the eminent German poet Ludwig Gottfried Kosegarten, Johann Friedrich Dieffenbach, the famous cleft palate pioneer born in 1792, is the taproot of this family tree. When Kenneth Dieffenbach, now a New Orleans plastic surgeon, came to Miami on a Maytag Fellowship, he acknowledged being a sixth-generation descendant of the first Dieffen-
bach in America, the family sharing a grandfather with the celebrated surgeon, eight generations back. Kenneth's great-great-grandfather was the first native pipe organ builder in America, and Kenneth still plays one of his organs. As a third-year clerk at Germantown Hospital, he watched Hans May do the first cleft palate surgery he had ever seen, following the operation with May's Second Edition lying open on the windowsill. Frustrated by an inconsistency in a drawing in the book, Dieffenbach trailed May to the dictation room, with the book under his arm, for an explanation. There was an error in the drawing, prompting May to ask his name, and when he got "Dieffenbach" in reply, he quietly opened the book to the dedication to Johann F. Dieffenbach. Dieffenbach then began a nomadic training in palate with Marcks, Latham, Cannon and finally Hoffman in New Orleans, where as chief resident on the LSU service he got to do his first cleft palate pushback. He recalled:

Bill Pollock of the Tulane Service, working next door, peered in momentarily with the question . . .: how was I going to cover the nasal surface of the soft palate defect? I realized that I had not even released the nasal side, much less lined it. With this burning provocation, the next pushback received an island flap, taking one and one-half hours, with no difficulty and in fact, with surprising ease. My only reservation was in regard to the aura of fear and cautioned restraint expressed by others about the technical application of the flap.

After residency, he took postgraduate training with Converse in New York and a Maytag Fellowship in Miami. As he said:

Fresh with functional velar results of Hogan's lateral ports, I landed in Miami to see how the fearsome island flap was done "at home."

After scrubbing on an island flap pushback, he gave this response, but one must remember his background for generations has been philosophy, medicine, music and poetry!

Watching the 290th Miami island flap absolved any hesitations I still had. After smooth scalpel dissection of the neurovascular pedicle had freed the island in no time at all, it was demonstrated with acrobatic ease that this nomadic flap could be plugged anywhere in the hard or soft palate. Tucked behind the hard palate on its back, it left the uvula curled gently against the pharynx when all was done.
MAILLARD

Gaston F. Maillard of Lausanne, Switzerland, a 1976 Maytag Fellow, observed an island flap palatal pushback and was asked for his reaction to the procedure as his previous training with Dufourmentel, Tessier, Clodius, Meyer and a stint at Canniesburn, Glasgow, Scotland, had been exceptional. This is what he wrote:

As a European trained in traditional schools, V-Y retropositioning and posterior pharyngeal flaps, I have to say you have to see it to believe it! In fact, it is difficult to imagine that by releasing the lining from the hard palate free edge, the most important defect lies on the nasal side. The oral is easily closed by the usual pushback. After having seen it, I am now convinced that, compared to the pharyngeal flap, it is a more physiological way to achieve the closure. On the other hand, it is a truly exciting plastic procedure: a double axial pattern island flap turned upside down at 90 degrees.

CARNEIRO

In early 1978 a bipedicle island flap was used to lengthen the nasal lining during a pushback in a 24-year-old Cuban girl who had had a von Langenbeck operation in childhood. Ronaldo dos Santos Carneiro of Porto Alegre, Brazil, a Maytag Fellow, expressed enthusiasm for the procedure. I asked him why.

I trained in Allentown, Pennsylvania, where one attending surgeon did Langenbecks and the other two did V-Y pushbacks and all feared a breakdown at the join of the hard and soft palate where often only one-layer closure is possible.

The island flap impressed me because of the ease of dissecting the neurovascular pedicles, ease of maneuvering the island into the nasal defect, and the amount of lengthening obtained. Also, the most troublesome area at the junction of the hard and soft palate received the best closure. The pharyngeal flap is not the only weapon against palate shortness.

WILLIAMS

It is interesting that Sidney Williams of Kingston, Jamaica, who trained with Braithwaite in Newcastle for four years from 1960 to
1964, explained in 1978 his infatuation for the past 10 years with the island flap:

In wide clefs with the Braithwaite approach, I had difficulty getting and maintaining a closure at the junction of the hard and soft palate. The island flap made this easy so I have used it many times.

CUBICCIOTTI

Gildo Cubicciotti of Naples, Italy, had been observing in Miami about two months. After the sixth pushback-island flap, he exclaimed at lunch in the Jackson Memorial Cafeteria one day in 1978, in mild excitement:

The first thing I'm going to do when I get back to Italy is an island flap in a palate!

I warned:

Do not do the island flap pushback before 4 to 5 years, and only in cases with good mobility and about 1.5 cm. gap between velum and pharyngeal wall.

EVEN IN THE HORSE'S MOUTH

Closing the cleft palate in the horse has been difficult (Kendrick, 1950; Batstone, 1966; Stickle, Gable and Braden, 1973). In 1975 R. S. Jones, D. O. Maisels, J. J. De Geurs and B. B. J. Lovius of Liverpool described cleft palate closure in three horses, facilitating the difficult exposure by mandibular symphysiotomy. They noted:

While simple paring and suturing will enable one to close clefs affecting the soft palate only, more extensive defects reaching forward into the hard palate demand more sophisticated procedures. These include raising flaps of mucoperiosteum from the hard palate to permit closure of the oral layer, while repair of the nasal layer requires mobilization of the mucosa, use of flaps from the vomer and occasionally even island flaps of oral mucosa as well (Millard 1962).
In 1972 S. Takahashi of Tokyo sent photographic records of his use of the island flap for an oroantral fistula, showing: (1) closure of the antral side, (2) dissection of bundle, (3) completed operation, (4) result two months postoperatively.

In 1977 Takahashi wrote:

The island flap of the palate is still used to close oroantral perforations in our clinic. Raw surface in the hard palate is smaller with the island flap than with the usual palatal flap method and the folding occurs at the lesser curvature of the palatal flap.

In one of his sections in the 1973 German book of clefts edited by Schuchardt, Steinhardt and Schwenzer, Werner Widmaier of Stuttgart presented diagrams of the use of the mucoperiosteal island flap by forward advancement for closure of an anterior central hard palate fistula. There was minimal local tissue available otherwise for occluding this hole. Excellent photographs of a representative case demonstrated the effectiveness of the principle clearly.
In 1974 in the *British Journal of Plastic Surgery*, D. C. Herbert of Liverpool presented a variation in the use of the island flap for the closure of a hard palate fistula measuring 3.0 cm. by 2.3 cm. An island flap was taken from the right side and an oblique furrow made on its buccal aspect in order to present a raw surface to the vomer. A mucoperiosteal flap from the left side was used for the second-layer closure.

Herbert noted:

It might be possible to close even larger fistulas by using mucoperiosteal island flaps from both sides of the fistula and placing them side by side in the nasal layer. Cover could be provided by a free graft or a tongue flap. In this way, it might be possible to close fistulas which involve as much as two-thirds of the area of the hard palate.

In 1974 in the *British Journal of Oral Surgery*, D. Henderson of Canniesburn Hospital, Glasgow, designed an interesting modification in the use of the island flap principle in closure of lateral oroantral fistulae.
If the fistula is placed further laterally, and therefore at a higher level in the buccal sulcus, the margin of the island will no longer coincide with the periphery of the excised fistula, and an intermediate bridge of mucosa will remain along the alveolar crest. In these circumstances, excision of the intervening bridge would result in unnecessary loss of tissue. Instead, it should be raised from the underlying bone (if necessary, a little of the bone itself can be removed) to allow the island to be tunnelled underneath the mucoperiosteum to appear in the buccal defect. Provided the original distal margin of the flap is undermined, the total periphery of the island can be gently drawn underneath the mucosal bridge and sutured round its circumference to the edges of the fistula. The bony funnel in which the greater palatine artery lies after its emergence from the greater palatine foramen may be enlarged laterally to increase the degree of upward and lateral movement of the nutrient pedicle, thus avoiding any threatening tension on the artery. This technique makes available a considerable hunk of well-nourished tissue for closure of the fistula without reducing the depth of the sulcus and without creating a bulge of soft tissue in the palate. After secondary epithelialization of the palatal defect, a very normal denture-bearing area is obtained. This may commend the method in some edentulous cases in preference to the traditional buccal advancement and palatal rotational flaps.

FIRST PALATE ISLAND FLAP

Now comes the punch line! In 1977 a reference by Worthington called attention to a German paper which, after translation, revealed that as early as 1939 Fritz von Brosch of Hamburg, a general surgeon who had become interested in oral surgery, described a mucoperiosteal flap based on a greater palatine neurovascular bundle, which he used for oral closure of "perforations in the area of alveolar +5 and +6." This flap was condemned by Fröhlich in 1948 because of "extensive isolation of the vessels" with "the peril of thrombosis and the danger of manipulation" only withstood by larger vessels. Such criticism frightened other surgeons away from accepting the method. In 1950 Brosch defended this mobilized palatal flap based on a neurovascular pedicle, explaining that it could rotate in a wide radius without the usual kinks and wrinkles of a standard mucoperiosteal flap and could be stretched to greater length to reach alveolar fistulae
inaccessible to the standard flap. It is true that Brosch did not turn the flap over or use it for nasal lengthening in cleft palate, but he was the first to use the island flap principle in the palate area!
34. Use of the Palatal Island Flap for Ablative and Other Defects

The principle of the island flap makes available large areas of mucoperiosteum supplied by a neurovascular bundle which can reach the distance of its pedicle a 360-degree area around the particular posterior palatine foramen. The donor area is backed by bone and, after full growth of the maxilla, will heal quickly without deformity. Thus the island flap is an epithelium-covered, independent, durable, maneuverable unit with many possible uses. In 1963 I predicted that this flap would be useful in soft palate defects following tumor ablation and trauma and in 1966 reported two cases briefly. One was a patient in whom a posterior pharyngeal and tonsillar resection for cancer treated with a skin graft had produced a pocket in the tonsil area that consistently trapped food. After excision of the graft, an island flap was fitted to fill out the pocket without further difficulties. In another case of subtotal soft palate excision, a wide pharyngeal flap based superiorly was covered with a large island flap to achieve partial soft palate reconstruction and improved velopharyngeal closure.

In 1969 Maisels reported a case of partial maxillectomy for squamous cell carcinoma arising on the alveolus which resulted in a bony defect in the nostril floor. At the time of ablation, a mucoperiosteal island flap carried on the contralateral greater palatine vessels was used to repair the defect.
In 1974 in the *British Journal of Oral Surgery* D. Henderson of Glasgow, Scotland, noted that oroantral fistulae following maxillary excision of relatively benign lesions can result in major defects requiring a permanent prosthesis or extensive reconstructive surgery. He designed a two-stage repair utilizing a palatal island flap, noting that at the second stage, reexamination of the operative area to exclude recurrence was possible. He advised against this procedure for cases of malignancy or palatal salivary tumors known to invade bone or bony canals.

Following resection of the lesion, Henderson developed island flap A and, when possible, removed the anterolateral wall of the greater palatine foramen for extra freedom. He inverted the island with the epithelium facing the antrum and advanced buccal mucosa by incisions (broken lines) to cover as much of the island as possible. No attempt was made to advance these flaps to the midline to close the medial fistula. Six months later, the second
stage involved two-layer advancement of both edges with closure of the nasal layer by direct suture. Closure of the oral layer by a longitudinal relaxing incision in the mucoperiosteum parallel to the medial edge of the fistula created a bipedicle bridge flap for advancement to the buccal flap. Other small buccal flaps were suggested, if necessary, for the anterior end of the hole.

Another case was reported of a 12-year-old female requiring a partial maxillectomy for an odontogenic fibromyxoma in 1969. Reconstruction by the two-stage island flap method followed with a partial denture which was still serving well after five years.

In 1974, in the *British Journal of Oral Surgery*, Philip Worthington of North Wales Hospital noted:

Some 55 percent of intraoral salivary tumours occur in the palate and of these some 55 percent are pleomorphic adenomata, 25-30 percent are muco-epidermoid tumours, 15-25 percent are cylindromata and 5 percent are carcinoma.

It is difficult to assess the limits of the pleomorphic adenomas, and they have a tendency to recur. On this basis it was suggested that a wide resection with fenestration of the palate may be necessary. Repair of the defect in six cases by Worthington involved an unlined oval island flap, based on the neurovascular bundle of the opposite side and transposed over the full-thickness palate fistula. He noted:

This application of the island flap may serve to remind us of its great versatility.

He then admitted, rightly:
Criticisms of the use of an unlined flap are likely to be directed along the following lines: first, the raw upper surface may be the site of undesirable crusting with an unpleasant odor. Secondly, the flap is likely to contract, causing velopharyngeal incompetence. Thirdly, the flap may fibrose and render the palate relatively immobile, interfering with normal function.

OTHER PERSONAL CASES

Here are four other interesting cases of mine, published in the *British Journal of Plastic Surgery*, in which the island flap has been useful.

Squamous cell carcinoma

A 46-year-old black male, with a lesion of his soft palate and no evidence of local node involvement, had biopsy which revealed well-differentiated squamous cell carcinoma. Local excision involved resection of the entire soft palate to its junction with the hard palate, including the tonsillar pillars on both sides. After healing, the patient experienced difficulty in taking liquids and soft foods, and his speech was unintelligible.

Six months later the reconstructive plan was designed, and resident H. A. Seider turned forward a wide, superiorly based pharyngeal flap and sutured it to the posterior edge of the palate. A mucoperiosteal island flap based on the left neurovascular bundle was lifted off the left hard palate and passed through a mucosal incision, connecting the donor area to the recipient site.
to overlap the underbelly of the pharyngeal flap. The reconstruc-
tion healed uneventfully, and six weeks later the patient was
having no difficulty with liquids or soft food and his speech was
near normal and improving.

Acinic cell carcinoma

Nasse in 1901 was the first to describe acinic cell tumors, and
Buxton in 1953 pointed out that these tumors can run a clini-
cally malignant course with recurrence and metastasis. A rare
acinic cell carcinoma of the soft palate in a 35-year-old white male
(1) was reported which required radical resection of almost the
entire left soft palate (Deutsch) (2). Healing produced a fistula,
contractures and velopharyngeal incompetence with a speech-
crippling effect not unlike that of an unoperated cleft palate (3).
As the patient was a prominent criminal lawyer, his speech defect
seriously impaired his performance in court and his livelihood.
Reconstruction was mandatory.
Ten months after ablation, scar excisions and release of contracture repositioned normal tissues (4 and 5). A right mucoperiosteal flap (B) was used to fill the nasal lining defect along the posterior edge of the hard palate. A superiorly based pharyngeal flap (E) was attached to the island flap and to the posterior edge of the palate defect to complete the reconstruction on the nasal side (6). Then a large mucoperiosteal island flap from the left side (C) was swung around for oral cover of the raw underbelly of the pharyngeal flap (7).

Speech improvement was almost instantaneous (one week). By one month, because of his effort and study to adjust to the defect prior to reconstruction, the patient felt that his speech was better than before the ablation. It is three years since reconstruction, and all is well.
Stenosis following T & A

A 13-year-old boy, six years after a tonsillectomy and adenoidectomy, presented a complete stenosis of the nasopharynx. One attempt at surgical correction had been unsuccessful.

On examination, the entire posterior edge of the soft palate was seen to be plastered with scar to the pharynx, showing a dimpling (arrow) but complete obliteration of the nasal airway. The patient had great difficulty when eating and breathing at the same time.

During surgery, the adhesion between velum and pharynx was divided, leaving large raw areas on the upper surface of the posterior soft palate and on the posterior pharyngeal wall. A flap of lateral pharyngeal mucosa was transposed to close the pharyngeal defect. Then the soft palate was split down the midline, and a left mucoperiosteal island flap was dissected free and passed through to cover the raw superior surface of the posterior soft palate. The velum was resutured, and healing was uneventful. With the nasopharyngeal aperture completely lined, it has remained patent four years with normal speech. The patient can breathe through his nose with mouth closed and eat and breathe simultaneously without difficulty.

Choanal atresia

At the University of the West Indies, Kingston, a 14-year-old Jamaican girl with a choanal atresia was treated by Kenneth McNeill, who cut the palatal mucosa with a through-and-
through incision just back of the posterior edge of the hard palate. This gave exposure so that he could remove the bony obstruction with a chisel and mallet to open the airway from the nose to the pharynx.

The raw tunnel thus created, since it was without lining, was destined soon to close off. A slender right mucoperiosteal island flap was dissected free on its neurovascular bundle. Following ostectomy of the posterior wall of the greater palatine foramen, the island flap was slid along the bottom of the tunnel and sutured in place. This supplied an epithelial strip to maintain a patent nasal airway until complete epithelialization of the tunnel could be achieved similar in principle to the skin strip used by Denis Browne to create a urethra. Recently the patient was examined and revealed patency of the nasal airway with normal breathing eight years after the reconstruction.
35. Long-Term Evaluation of the Palatal Island Flap

TEN-YEAR EVALUATION IN MIAMI

After our 10 years' experience, a report in Plastic and Reconstructive Surgery on the palatal island flap noted in 1970 that, although 200 island flaps had been used for palate lengthening in all types of cleft problems—primary and secondary—only 73 cases could be reexamined for evaluation. This low percentage was due to the often transient population of South Florida and to the inaccessibility of many of the children in the Bahamas and the West Indies. The results, although not mathematically exact, did serve to give a general impression. With Jack Bensen as the constant speech analyst, J. H. F. Batstone of Oxford (1966) and M. H. Heycock of Great Ormond Street Hospital for Sick Children (1969) carried out the clinical assessments. Both Batstone and Heycock were from British units which did not employ the island flap; neither had been involved previously in the cases studied. They were interested in but had no loyalty to this method. Many patients tested by Batstone were retested by Heycock, without knowledge of the outcome of the previous examination—but the results showed no significant difference. During the assessment, attention was directed to the palatal mobility, length, speech results and fistulae.

Mobility

A control survey of speakers without clefts revealed that normal mobility ranged from moderate to excellent with a fairly even scatter. Out of 24 patients with complete clefts, 20 had mobility
within normal range and three had fair movement. In those with incomplete clefts, 25 out of 30 were within normal limits. Thus about 85 percent had satisfactory mobility, a result suggesting that, unlike the synechia of a pharyngeal flap which reduces palatal mobility, the island flap allows normal movement.

Length

Palate length in normal patients varied from moderate to very long. In 46 out of 59, palate length was within normal limits. Thus 78 percent had satisfactory length. Short results in complete clefts were found to be associated with a general lack of tissue, as seen in some bilateral and severe unilateral clefts. Short results in incomplete clefts again seemed to be associated with gross lack of tissue, as in the horseshoe-shaped palate with a wide cleft and short palatal elements. Two failures in submucous clefts occurred in short palates operated on at 9 and 11 years of age.

The occasional failure in lengthening that occurred with no apparent cause has to be blamed on too small an island flap or subsequent necrosis and contracture.

Of course, length and mobility are interrelated; often good activity will make up for some palatal shortness and vice versa.

Speech Results

Speech was assessed strictly and dispassionately. Nasal escape was determined primarily by its audibility but confirmed by the misting of a mirror held under the nose while a prolonged s and e were pronounced. The mirror was marked in accordance with the judgment of the speech pathologist.

Speech was graded “normal,” “slight nasal escape,” “moderate nasal escape,” and “gross nasal escape.” “Normal” meant absolutely normal. “Slight nasal escape” was very slight and probably would be passed as normal by most surgeons (and certainly by the lay public). “Moderate” and “gross” nasal escape indicated degrees of abnormality (Table 1).

Patients with normal speech or slight nasal escape were considered to have satisfactory results (approximately 80 percent). Those with moderate or gross nasal escape were considered to be failures.
Table 1. Type of Cleft and Speech Result (from Primary Operations)

<table>
<thead>
<tr>
<th>Cleft Type</th>
<th>Normal Speech</th>
<th>Slight Nasal Escape</th>
<th>Moderate Nasal Escape</th>
<th>Gross Nasal Escape</th>
<th>Mentally Retarded</th>
<th>Satisfactory Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>10</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>18 out of 24</td>
</tr>
<tr>
<td>Incomplete</td>
<td>18</td>
<td>7</td>
<td>4</td>
<td>—</td>
<td>1</td>
<td>25 out of 30</td>
</tr>
<tr>
<td>Submucous</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>4 out of 5</td>
</tr>
</tbody>
</table>

FAILURES IN COMPLETE CLEFTS.

1. A bilateral cleft in which we closed the soft palate only, and left the anterior palate open for premaxillary retropositioning.
2. A mentally retarded patient.
3. A small island flap early in the series, with a particularly wide cleft.
4. Repaired at 10 years of age.
5. Repaired at 12 years of age.
6. Anterior palate closed elsewhere previously.

FAILURES IN INCOMPLETE CLEFTS.

1. A mentally retarded patient.
2. A horseshoe-shaped cleft.
3. An extremely short palate initially.
4. A cleft of the soft palate in a 2½-year-old child.

FAILURE IN A SUBMUCOUS CLEFT. This was a girl of 9. She had had normal speech until her tonsils were removed at the age of 4. She then developed a severe speech problem, which was not helped by the island flap operation.

In summary, the more mobile palates seem to produce better speech—but there was one child with an immobile palate which, although short, allowed only slight nasal escape (Table 2).

In this study it was obvious that the longer the palate, the better the speech results. As in normal people, there were some patients who sometimes made up for deficiencies in palatal length by extreme mobility of the pharynx (Table 3).
Table 2. Mobility of Palate and Speech Results

<table>
<thead>
<tr>
<th>Mobility</th>
<th>Normal Speech</th>
<th>Slight Nasal Escape</th>
<th>Moderate Nasal Escape</th>
<th>Gross Nasal Escape</th>
<th>Mentally Retarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Clefts, Closed Primarily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>—</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Moderate</td>
<td>—</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Good</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Excellent</td>
<td>1</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Incomplete Clefts, Closed Primarily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Slight</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Fair</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Moderate</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Good</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Excellent</td>
<td>4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3. Length of Palate and Speech Results

<table>
<thead>
<tr>
<th>Length</th>
<th>Normal Speech</th>
<th>Slight Nasal Escape</th>
<th>Moderate Nasal Escape</th>
<th>Gross Nasal Escape</th>
<th>Mentally Retarded</th>
<th>Satisfactory Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Clefts, Closed Primarily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very short</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Short</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>Moderate</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>5 out of 10</td>
</tr>
<tr>
<td>Long</td>
<td>5</td>
<td>4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>9 out of 9</td>
</tr>
<tr>
<td>Very long</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1 out of 1</td>
</tr>
<tr>
<td>Incomplete Clefts, Closed Primarily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very short</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1 out of 1</td>
</tr>
<tr>
<td>Short</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>4 out of 6</td>
</tr>
<tr>
<td>Moderate</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>7 out of 9</td>
</tr>
<tr>
<td>Long</td>
<td>11</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>12 out of 13</td>
</tr>
<tr>
<td>Very long</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1 out of 1</td>
</tr>
</tbody>
</table>

Duke Evaluation

In 1969, in the Cleft Palate Journal, Georgiade, Mladick, Thorne and Massengill evaluated their 54 island flap cases. They noted that the majority of the patients were too young to permit standard cleft palate speech studies. Cinefluorographic tracings of the distance from velum to pharyngeal wall during phonation of
were obtained in 16 of the older patients. Three to six months after surgery, six patients (38 percent) had complete velopharyngeal closure, and 10 had a gap during phonation. Both fine braided wire markers placed in the midline on the anterior and posterior edges of the island during surgery were retained in 14 patients. Measurements by x-ray, between markers or the widest part of the island, showed that the amount of nasal lengthening shortly after surgery averaged 16 mm. Measurements taken three months later showed a mean decrease of 4 mm. or 25 percent shrinkage. There was a 4 percent incidence of postoperative fistulae. The mobility of the velum was reported to be impressive even in the very early postoperative examinations, and the asymmetry was not significant. In an observation that proved to be a prophecy, the authors noted:

The operation denudes more bone than the usual pushback, which may be detrimental to palatal growth. It does not appear to have the added disadvantage of the Cronin procedure in which both the nasal and palatal mucosa are elevated, thus denuding portions of the palatal bones on both sides.

They concluded:

In our opinion, the procedure is good technically. However, it must be used with discretion for older patients and patients with wide cleft palates.

In 1977 Nick Georgiade sent this follow-up:

Ray Massengill, our Speech Pathologist, feels the results are about what we stated in the 1969 article. Also, there is no appreciable difference in the speech in these patients who have had the Island Flap and those who have not, in our series of approximately 80 patients.

**MONTEFIORE EVALUATION**

In 1975, in the *Cleft Palate Journal*, Lewin, Heller and Kojak, of Montefiore Hospital, the Bronx, New York, studied their results with the island flap pushback procedure. They summarized:

Twenty-four patients were evaluated for voice quality after primary palatal repair by the Millard island flap procedure. In patients with overt cleft palate, acceptable speech was obtained in 71 percent. In patients with velopharyngeal insufficiency without an overt cleft, the success rate was 60
percent. Although we consider this method reliable and useful, we have no reason to believe that it offers substantial advantages over other established procedures. We suggest that the main reason for our failures to achieve velopharyngeal competence and acceptable voice quality after a repair is the inherent hypoplasia of palatal musculature.

A fascinating observation was made by this group:

Examining our lateral cephalograms we noted an interesting finding regarding the configuration of the palate after the Millard island flap operation. In a few patients, in addition to the “knee” (levator prominence), we noted on phonation another elevation anterior to the “knee.” This double hump, which we refer to as a “camelback” appearance, probably corresponds to the observation of Pigott et al. and Millard of buckling and puckering of the flap on the nasal side. However, some patients with the “camelback” palate had adequate voice quality, and we could show no correlation between this radiologic finding and voice quality.

Here is a “camelback” palate with a voice quality rating of 2.3 shown at rest and phonating “Eeee...”

Another “camel” with a voice quality rating of 1.0 at rest and phonating “Eeee...”
Little did it ever occur to me that I have been propagating two-humped "horses" as referred to in the Preface of Volume I.

HOPKINS EVALUATION

In 1976 Luce, McClinton and Hoopes reviewed patients of the Facial Rehabilitation Clinic of the Johns Hopkins Hospital who had had a primary repair of a cleft palate by the unilateral small elliptical island flap technique performed between January 1, 1965, and December 31, 1971. They summarized this seven-year follow-up.

We analyzed all 104 island flap pushback palatal repairs done through our Facial Rehabilitation Clinic in the period from 1965 to 1971. The results were compared to those in a group of 109 standard pushback repairs.

The island flap group had a higher incidence of operative complications, of velopharyngeal insufficiency, and of secondary procedures to correct the latter. (The differences between the two groups were not statistically significant, however.)

In this group of patients the island flap repair offered no particular advantage over the V-Y or the Dorrance push-back; in fact, it may have been deleterious.

A hypothetical explanation for these results is offered, based on possible continuing osteogenesis by the transplanted mucoperiosteum, to produce an inflexible and poorly functioning velum.

They did admit:

Thus, the final result of excellent or good speech was obtained in almost 85 percent of the island flap group. Unfortunately, the retrieval of that final result necessitated frequent reoperation, rather than less frequent reoperation as had been anticipated by the early devotees of this procedure.

I cannot imagine why so many operations were required. An occasional pharyngeal flap should solve most residual problems. It was a bit more encouraging to hear personally from John Hoopes in 1977:

It has been my feeling that the island flap pushback palatoplasty is the only procedure which results in significant retro-displacement of the levator sling. I have, therefore, in my personal series utilized (almost exclusively) the island flap pushback for repair of cleft palate. Needless to say, I was distressed by the data in the recent paper by Drs. Luce, McClinton and
myself. It is imperative, now, that I extract from that data those island flap pushback procedures performed only by myself—in that I, personally, have had no postoperative fistulae, and my patients have not (inordinately) required secondary pharyngeal flaps. In spite of the data, I continue to utilize the island flap pushback—simply because I have no procedure available which significantly retro-displaces the levator sling.

**BUTTERWORTH EVALUATION**

In 1975 Blocksma, Leuz and Mellerstig of Grand Rapids, Michigan, reechoed the plea against early mucoperiosteal flap dissections:

We analyzed all the cleft palate surgery performed from 1963 to 1973 in Butterworth Hospital. . . . Evidences of long-term complications in our own patients, and those of others, who had been repaired by the traditional mucoperiosteal flap techniques led us early to the conclusion that such operations as the Dorrance pushback, the Wardill V-Y pushback, the Millard island flap and the typical Von Langenbeck operation were all to some extent implicated in the gradual development of facial deformity. Many patients who had had an early mucoperiosteal flap closure looked excellent at the age of 5 years, but exhibited evidence of serious maxillary growth arrest at the age of 15 years.

Blocksma leveled a direct attack on the island flap, but from his description it is obvious that he was still using the original elliptical island instead of the larger modern ones.

Secondary pharyngeal flaps were required in as many patients after radical palate lengthening procedures as after our conservative closures.

In all likelihood our study included a disproportionately large number of older patients who had had complications after repeated radical closures. It is significant that 22 of our 43 patients who had been treated by the Millard island flap procedure subsequently required a pharyngeal flap (51 percent); 90 percent of the 43 showed a significant contracture of the alveolar arch. We concluded that this procedure provides considerable additional tissue on the oral side, and a dubious increase in length on the nasal side, at a very high price in subsequent deformity.
MY EVALUATION AFTER THE FIRST 19 YEARS

At the time of its conception, it was hoped that the island flap for lengthening nasal lining would be a universal panacea for all palate problems. Nineteen years and about 300 island flaps later, it has been found that such is not the case. With the aid of Walter R. Mullin, our most recent study of 141 available island flap pushback cases revealed that 12 had required later addition of a pharyngeal flap (8.5 percent). Among these 12, two were mentally retarded, one had multiple congenital anomalies including lack of half of the soft palate (A), one had a wide cleft of the soft palate (B), and one was a CPI with a deep pharynx who developed severe nasal escape after a T & A. A pushback with an island flap was followed in two years with a pharyngeal flap, and three years later with lateral pharyngeal flaps to reduce lateral escape and to produce normal speech. Another had a short, scarred secondary palate with a posterior gap of 2 to 3 cm. (C).

Most of these cases received the pushback, with an island flap as a secondary procedure, later than the ideal age, varying from 6 to 26 years. Two were primary island flap pushback cases at 16 months of age (1962) and 20 months (1961), and each of these had a horseshoe-shaped deformity with severe deficiency of tissue of the soft palate musculature. Continued nasal emission or development of emission after T & A precipitated the addition of a pharyngeal flap one to eight years after the pushback, with an average interval of 3.2 years.
Four more cases face the possibility of having a pharyngeal flap, which would make a total of 11.5 percent. These cases either had the pushback-island flap as a secondary procedure, resulting in more nearly normal speech which speech therapy is attempting to improve, or were early primary pushback-island flaps in clefts with severe deficiency of soft tissue musculature.

As in all plastic surgery, the choice of the case is important. The mucoperiosteal elliptical island based on one or, preferably, both posterior palatine neurovascular bundles can be turned over to supply as much as a 20 × 30 mm. (usually 12 × 30 mm.) stiff mucosal patch—to fill the nasal gap produced by the release and backward migration of the levator muscles and soft palate. There are limitations as to how much palate length this flap can achieve and how much flap some palates can spare.

When the island flap can be spared and the required lengthening does not exceed 12 mm., this procedure is ideal. It is physiological and it does not impede palate mobility while achieving permanent length. It is not effective in a paralyzed palate, but when scarring has produced some immobility the release can be dramatic.

Preservation of a triangle of mucoperiosteum anteriorly, as well as the adjunct of retropositioning and suturing the levator veli palatini muscles, is now included in the standard pushback-island flap procedure.

**Berkowitz**

Of course, the question of maxillary distortion always arises in any palate operation, but according to Berkowitz in 1970, the island flap was not causing more distortion than other methods when orthodontic correction had been carried out by the usual techniques, if indicated. Since then, however, there has been enough evidence of distortion following primary pushback with an island flap to cause Berkowitz to request postponement of this more radical surgery until age 3 to 5 years. As he noted at the end of his Chapter 4 in this volume:

An island flap will not cause palatal deformation if performed on a well-developed palate with adequate tissue and if the lateral incisions are made at least 5 mm. medial to the dentition.
Berkowitz has been following my cases with lateral cephalometric studies for many years. Here are some of his observations on the pushback with an island flap:

**Palate lengthening using the "island flap"**

1. *Congenital palatal incompetence (CPI)*

   The failure of the velum to make contact with the retropharyngeal wall in CPI is usually due to an excessively deep pharyngeal space. Pre-surgical evaluation of the palatal tissue is crucial in determining the adequacy of the tissue for palatal lengthening. A ten-year monitoring of palatal development following the island flap led us to conclude that the least deleterious effect resulted when surgery was postponed until 5 years of age, when 80% of palatal growth was completed. The worst effect resulted when the island flap was used as a primary cleft closure procedure, and the lateral incisions were made close to the teeth.

2. *Isolated cleft palate*

   4 years Preoperative evaluation: Short velum associated with a relatively deep pharyngeal space and a sparse adenoid mass.

   6½ years At rest. Velum lengthened by island flap.

   6½ years Vocalizing "Youuu. . . ."

      Good elevation with a velopharyngeal gap of 5 mm.

      Vocalizing "Ssss."

   7½ years The velum increased in A-P length and was able to make contact with the pharyngeal wall at the adenoid.
7½ years The stretch reflex was still evident a year later. The functional velum appears to become thinner than when at rest. The lengthened velum remained the same length one year after surgery.

3. Submucous cleft palate

Cephalometric and model analysis associated with an island flap performed at 4½ years of age. Successful reduction of hypernasality.

3 years The velum is too short to function adequately within this pharyngeal architecture.

4½ years After the island flap procedure during vocalizing of "Youuu..." The velum elevates and makes contact with the adenoid.

7½ years. At rest. Vocalizing "Youuu..." Vocalizing "Suu"

3 years. Preoperative. 4½ years. Postoperative. At rest. Vocalizing "Youuu..."

6 years. At rest. Vocalizing "Youuu..." Vocalizing "Suu"
6 years At 6 years, the velum lies on the dorsum of the tongue at rest. During function the velum makes good contact with the adenoid. Hypernasality was reduced postoperatively, and there was no change in velar function one and a half years postoperatively.

4. Failure of the "island flap" procedure

The velum did not reach the posterior pharyngeal wall during function. Postsurgical cephalometric examination revealed the failure of the velum to obturate the nasopharynx during function. One cannot presume that all velar pushbacks will function adequately.

In this instance a pharyngeal flap was performed to further improve airflow control. The need to perform a pharyngeal flap should not necessarily condemn this palatal lengthening procedure, for there are instances when a pharyngeal flap can also fail in its purpose. Further research is necessary to relate the condition of the palate, the depth of the pharynx and velar length to the surgical procedure of choice.

MODERN PLAN

I now close the soft palate at the time of the lip adhesion or definite closure, and the hard palate when the operation can be accomplished without more than lateral relaxing incisions and moderate undermining at 18 months. Then I wait to see how speech will develop. In the 25 to 30 percent of patients with velopharyngeal incompetence, an island flap pushback at 4 to 5 years can be carried out if the velopharyngeal gap is no more than 1.5 cm. and the mobility of the palate is good. If not, a pharyn-
geal flap or an island combined with a pharyngeal flap may be indicated. In fact, in patients with a short velum, reasonable mobility and a large velopharyngeal gap, I have come to employ the combination of an island flap in a pushback to enable the lengthened palate to make good use of its muscle action. Moreover, I add a superiorly based pharyngeal flap not only for reduction of the large space and the obturator effect but to act as a high, resting, unrestricted suspensory tether to hold the velum backward and elevated, to reduce the velar excursion necessary for functional pharyngeal closure. The pharyngeal flap can be as large as the cleft tissue deficiency requires or as small as a Stellmach adhesion. The reduction in the amount of lift the palatal muscles must continuously and rapidly achieve not only increases efficiency but reduces fatigability. This combination wins in most cases, even in the face of large tissue deficiencies. Thus, in the first three months of 1978, the simultaneous combination of a pushback with an island flap and some type of pharyngeal flap has been used in five out of the last 10 secondary cases, with an age variation of 9, 14, 17, 19 and 25 years. For a more detailed evaluation of an evolutionary series of palatal closures including island flaps see Chapter 46.