32. Development of the Palatal Island Flap for Nasal Lining

ONLY 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 push-backs, 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

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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

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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:
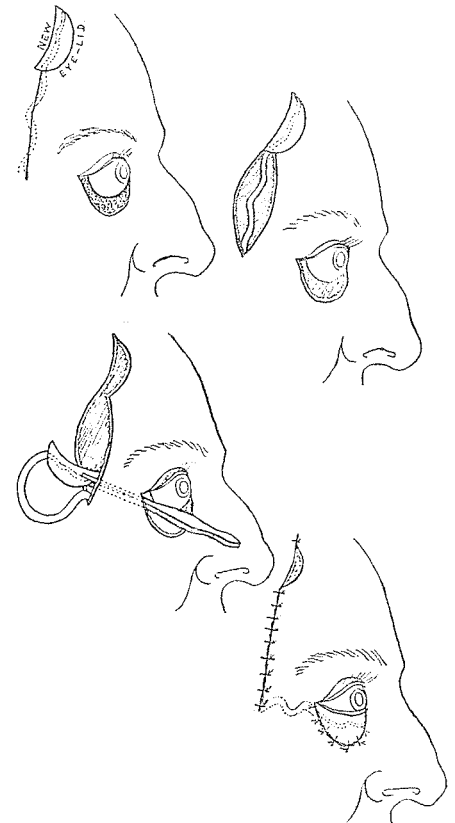
I had a little fear that it would slough for, even when it was in place, the strong pulsation across it from end to end was sufficiently reassuring.

Philippe Blandin

George Monks

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
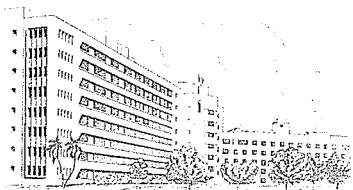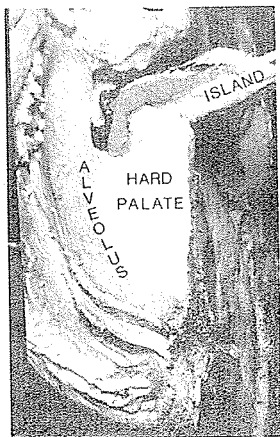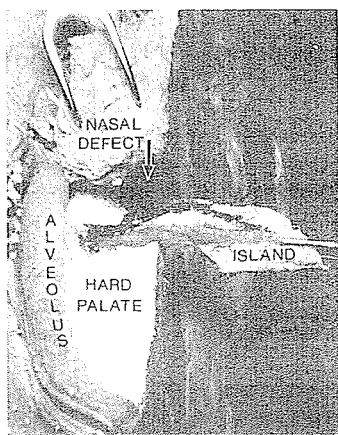
and turned at various angles without color improvement. The prognosis was guarded, so I decided to place the island, not into the nasal defect out of sight as planned, but longitudinally in the oral closure of the cleft where it could be observed, the hope being that it would regain its vascularity and 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.

It is possible that previous surgery had divided the vessels.

ugh!

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.

A happy island

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 palate 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

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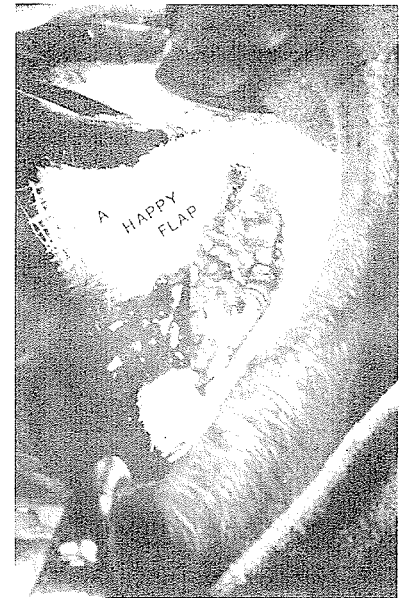
smoother postoperative recovery after coverage of the nasal raw area, avoiding the usual discharge, discomfort and ultimate distortion.

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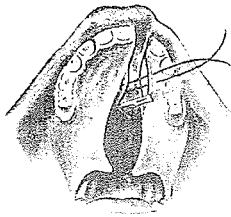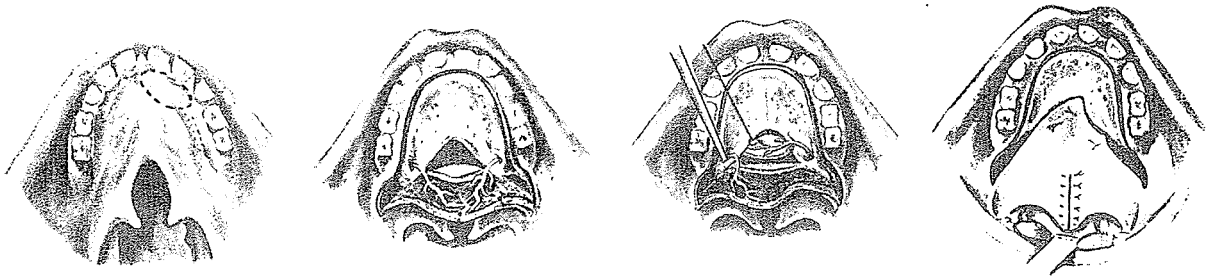
The same procedure was sketched again by Shirley Durkee in a complete cleft after first-stage closure of the anterior cleft with a vomer flap.
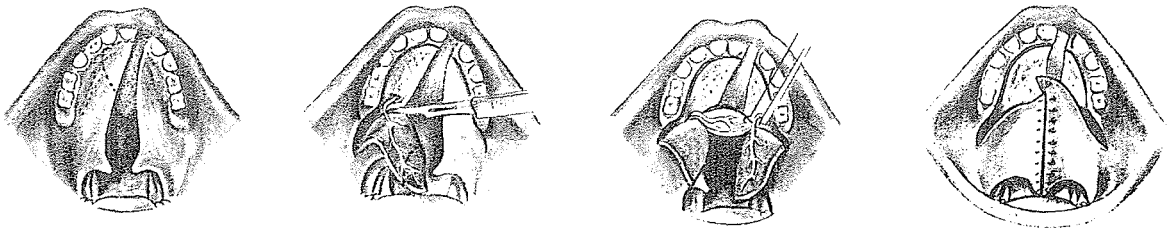

Previously inevitable contracture was now avoidable by the insertion into the gap of this stiff vascular island. With such a "filler" available, the nasal mucosa of the soft palate on either side of the cleft could be divided and pushed back more radically. An extra dividend was thus provided. Each soft 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.
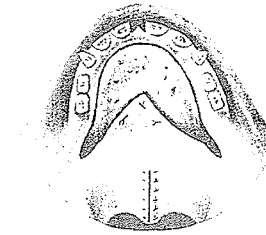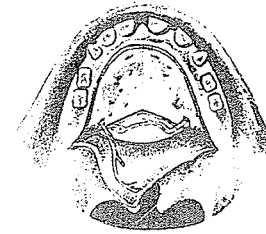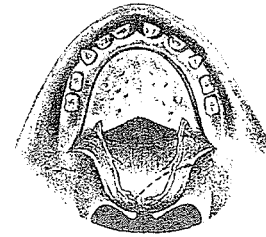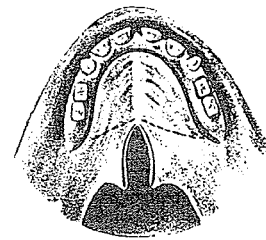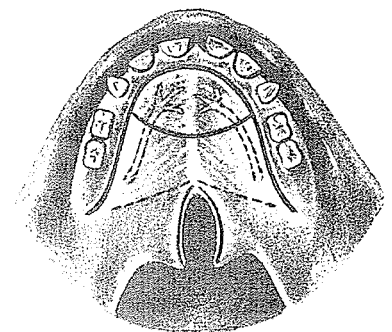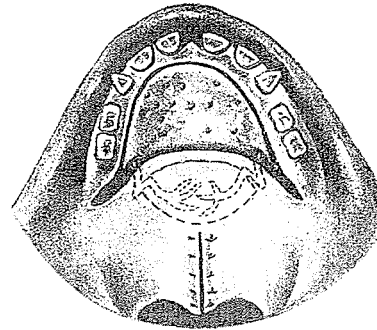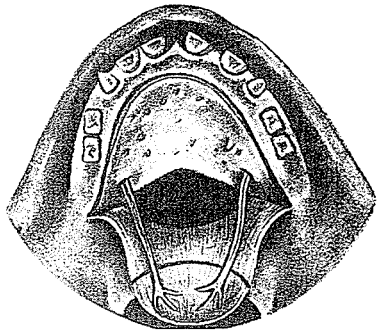
Incomplete cleft
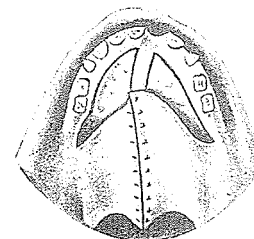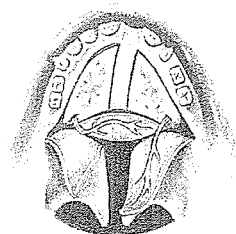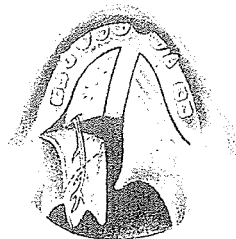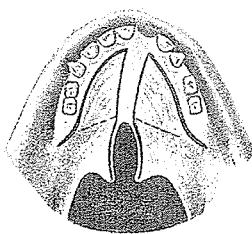
(2nd stage) Complete cleft

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.

Surgeon's up-side down View
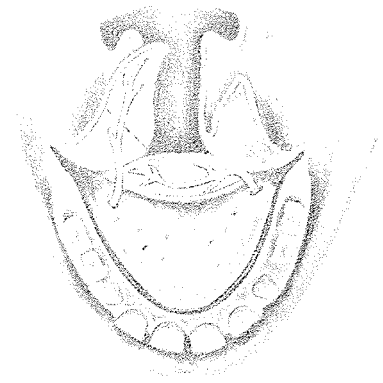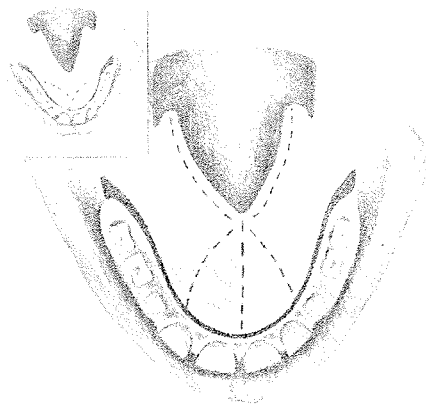
In 1966 in *Plastic and Reconstructive Surgery* the use of two island flaps was advocated, one for the usual nasal lining defect and the second to be introduced into the actual cleft on the oral side to reduce the side-to-side tension of direct closure. Division of the nasal mucosa from the posterior edge of the hard palate not only allows retropositioning but also facilitates medial advancement of the lateral elements a moderate amount. One island

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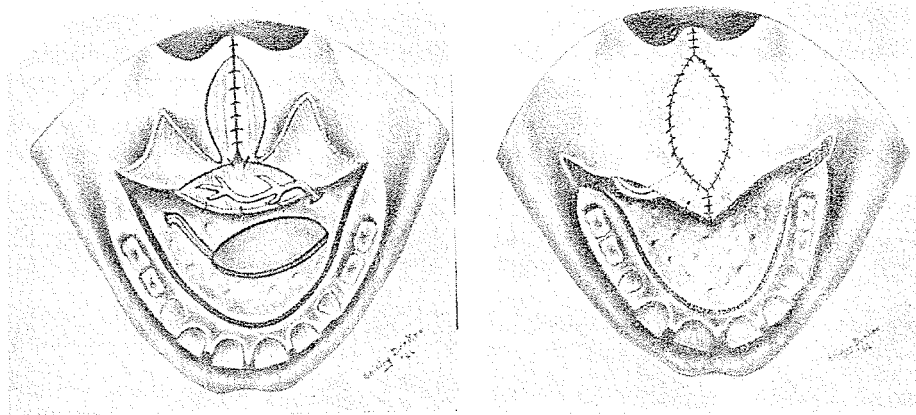
will fill the pushback nasal gap. If the mucosal edges of the cleft are turned over, they can be joined for the nasal closure more easily in the midline, but the oral edges of the cleft are left gaping. The second island can be fitted into this defect to obtain closure without tension. The remaining 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.

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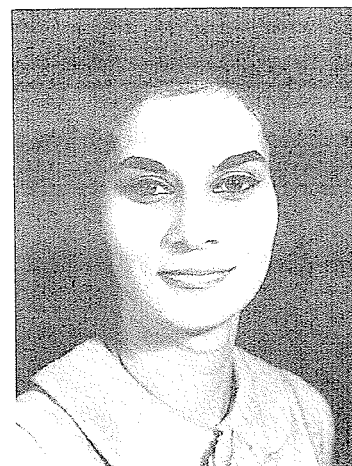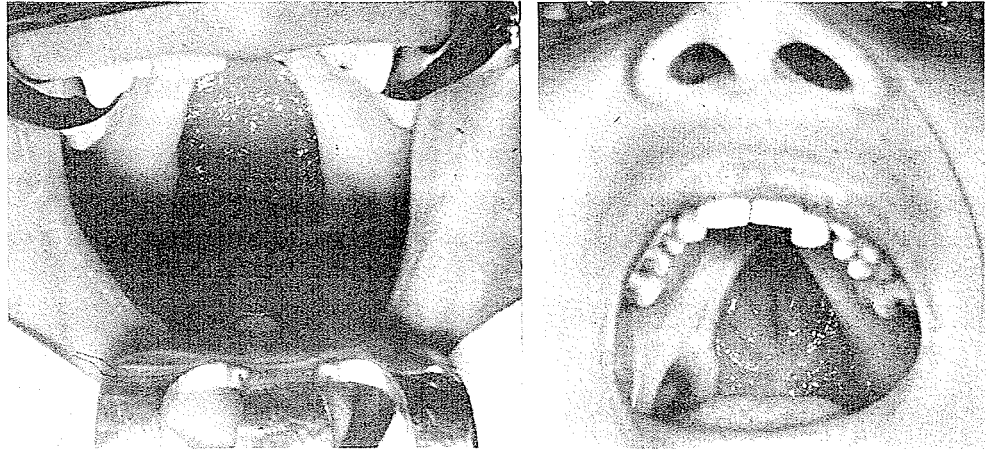
As this patient had excellent teeth in good occlusion, I was unwilling to condemn her to an obturator for the rest of her life. In spite of the expertly compiled evidence to the contrary, surgical closure was carried out on July 8, 1963. With the patient on prophylactic penicillin for her cardiac condition, 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.

This one for Gillies
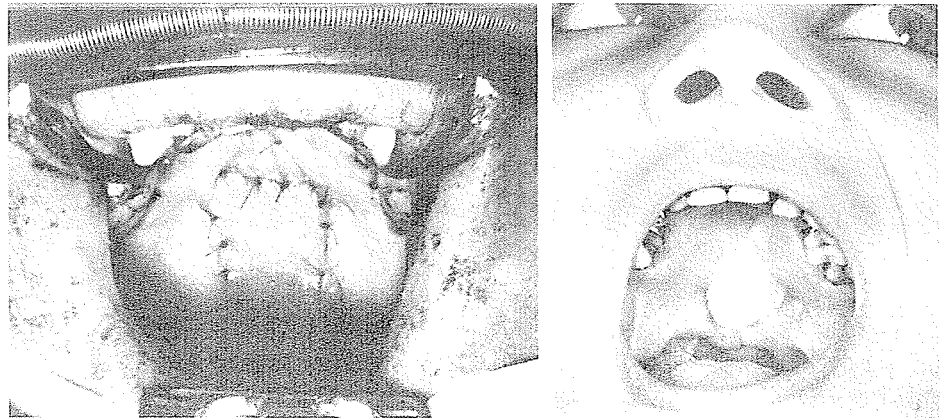
Evaluation by a speech therapist two months postoperatively revealed great improvement in speech but marked nasal emission of air and sound. Cinefluorographic examination showed a soft

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.

Langenbeck

Langenbeck + PPF

V — Y

Dorrance

Gillies — Fry

Pushback + Island Flap
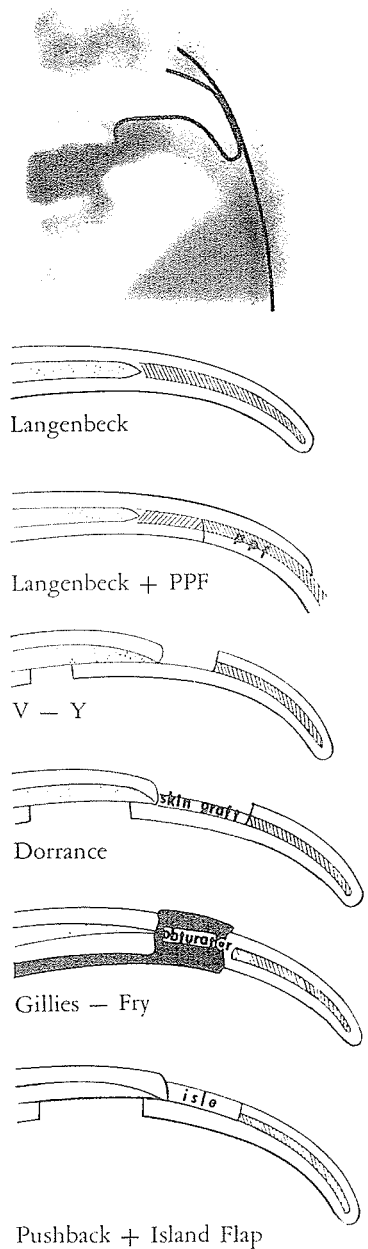
Cronin did acknowledge:

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 repositioning 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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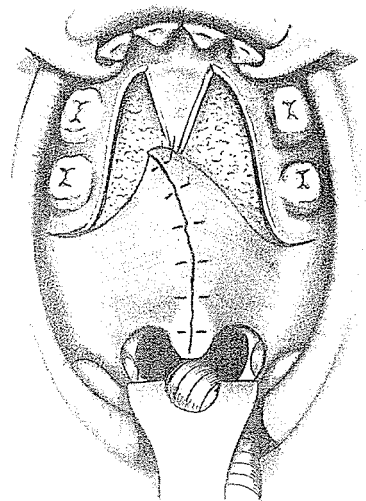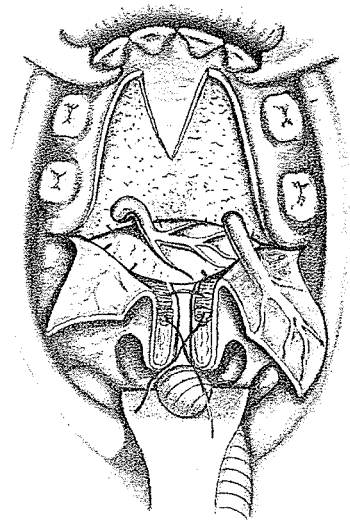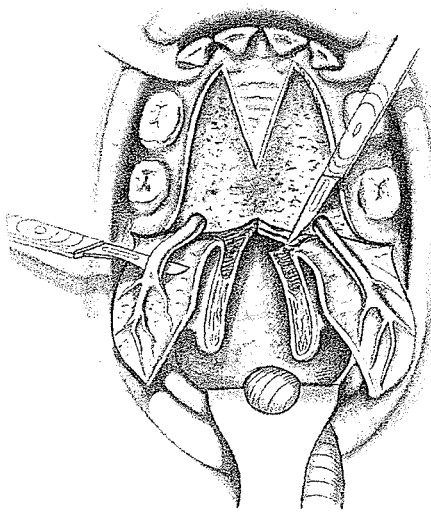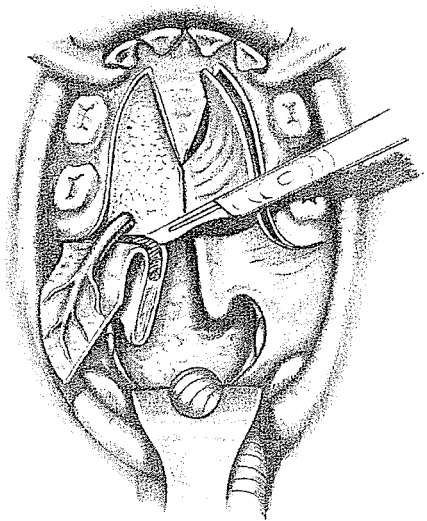
Stimulated by Maytag Fellow Malcolm Deane of Bristol, I began, *à la Braithwaite*, to dissect the fanned-out levator muscle into two discrete muscle bundles. This dissection was done just before dividing the mucosa along the edge of the hard palate—to maintain a fixed point and thus facilitate that part 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-

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A

B
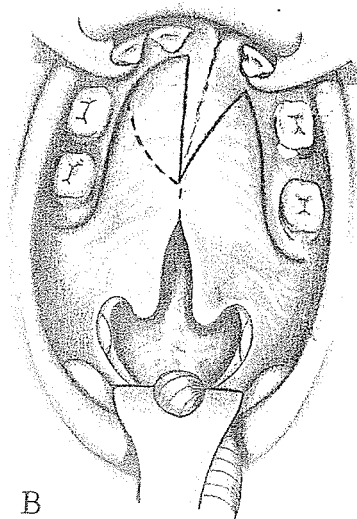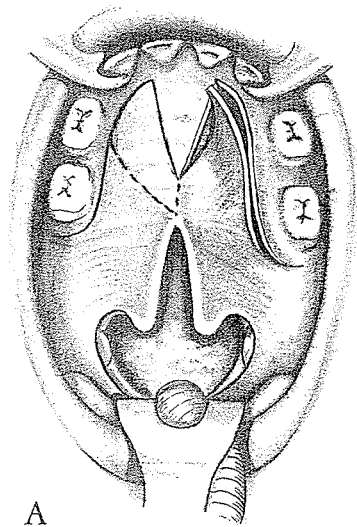
pounded by the absence of mucoperiosteum in the vicinity of the fistula, making secondary closure most difficult.

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.

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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.

no Evel Knievel stunt