I. Primary Deformity
Bradley Patten of the University of Michigan, after a lifetime of research, in 1971 revealed an expert’s acceptance of the unknown:

Why clefts of the lip are sometimes unilateral and sometimes bilateral is not known. There seems no reason to suspect that their genesis differs in anything other than symmetrical or asymmetrical distribution of whatever the disturbing agent might have been.

The various embryological theories in vogue today have been discussed in some detail in Volume I. Whether it be failure in the fusion of Dursy-His, or failure of the mesodermal migration of Fleischmann-Veau-Stark, or failure of the merging of Patten, or a
combination of these, whatever fails on one side in unilateral clefts fails on both sides in the bilateral deformity. At least in the standard bilateral cleft the site of the clefting is situated consistently along the embryonic grooves dividing the *maxillary* and *nasolateral* prominences from the *nasomedial* prominence. There can be varying but equal degrees of unsuccessful obliteration of these embryonic grooves on both sides or asymmetrical differences between the two sides.

The doubling of the fissures more than doubles the problem in the original deformity and its exaggeration during intrauterine growth and thereafter. The results of this will be discussed in Chapter 2 on anatomy.
The primary palate and the secondary palate are delineated by the incisive foramen as the central landmark and sutures extending anterolaterally to the spaces between the maxillary lateral incisor and the first canine tooth on each side. This description was originally noted by Fogh-Andersen and later simplified and popularized by Kernahan and Stark.

As stated succinctly by Kernahan for Stark’s book *Cleft Palate* in 1968:

The classification was based on the evolution and mode of growth of tissues forming the primary and secondary palates. Briefly, the primary palate—comprising the central portion of the upper lip, premaxilla, upper incisors, and anterior nasal septum—forms between the fourth and seventh weeks of intrauterine life and extends to the nasopalatine canal site of the incisive foramen. The secondary palate—comprising the remainder of the hard palate and the soft palate posterior to the incisive foramen—forms between the seventh and twelfth weeks as a pair of shelves that grow toward the midline and fuse in a normally developing embryo.

In view of these findings, the genesis of both rare and common lip and palate deformities becomes obvious. Either the primary or secondary palate or both may be involved, resulting in a degree of malformation from a submucous palate cleft or a vermilion notch to a bilateral cleft involving all dimensions of both palates.

**BILATERAL PECULIARITIES**

Certain aspects that are peculiar to bilateral clefts deserve special consideration. In the complete bilateral clefting the central frontonasal component is separated from both lateral elements. The middle segment seems thus to be released from any responsibility to the lateral elements, and they in turn, being somewhat passed by, withhold their usual contribution to the central element. Although the same cleft discrepancies occur as in the unilateral cleft, doubling the action compounds the effect on the central portion, including the prolabium, premaxilla, columella and septum.
Before Veau got Fleischmann and Hochstetter together on the mesodermal migration hypothesis, Thomas F. Mullen of San Francisco in 1932 made some interesting observations:

I have never been able to demonstrate any muscle in the parings from the margins of the prolabium in complete bilateral clefts of the lip. . . . A study of the reported cases of cyclopia in which the nasofrontal process fails to descend and enter into the formation of the mouth but remains above the single eye in the form of a proboscis reveals the fact in many instances that while there was an absence of the premaxillary bones, the lips were normal. Evidently in these cases the maxillary processes have united in the mid-line and the lips have been formed without any elements from the nasofrontal process (Craig, Malherke, Priano). I am of the opinion that the orbicularis oris never receives any fibers from the nasofrontal process but that the muscle elements grow into this area from the sides and there is never any muscle in the isolated prolabium of complete bilateral clefts. . . . The fact that the entire muscle bed from which this whole system is developed is confined to the area of the hyoid arch until the seventh week, whereas the lips are formed by the union of the maxillary processes with the median processes before this time, may account for the fact that there is no muscle in the tissues of the prolabium in complete bilateral clefts.

Miroslav Fara with histologist J. Smahel of the Plastic Surgery Clinic created by Burian at Charles University, Prague, finding no striated muscle fibers in the prolabium of complete bilateral clefts, concurred in 1967 with the earlier deductions by F. Burian, Albert D. Davis and I. Stanek:

The muscle fibers of the musculus orbicularis oris are not formed as a result of the transformation of the mesenchymal cells in situ, but . . . as a result of the growth of said muscles from the side toward the center of the philtrum. The formation of a complete cleft, which in embryogenesis precedes the growth of the muscular fibers, thus causes the sterility of the prolabium.

Union of the orbicularis oris muscle in the upper lip can occur independently of the frontonasal process participation. In cyclopia, the primitive proboscis projects above the single central eye, and the intact upper lip has muscle union below it. Yet this lip is not normal and presents no philtrum columns, associated vertical groove or cupid’s bow. Thus I would like to hypothesize
that although the frontonasal component contributes no muscle to the upper lip its participation in the "philtrum party" is responsible for partial midline interruption of what would otherwise be a flat, uninteresting end-on union of the lateral muscle bundles. Instead, when the frontonasal component normally enters from above, descending vertically between the muscled maxillary elements, it causes ripples expressed in columns, dimples and the curves of Cupid.

Just how this process takes place is still open to argument. In 1962 Monie and Cacciatore of the University of California, San Francisco, after the first real research on this subject, reported no evidence that the philtrum is related to the lines of fusion of facial processes in the embryo. Rather, they said, it is associated with increasing median density of connective tissue of the upper lip apparent between the third and fourth months of fetal life.

One bilateral cleft closure in which I was able, without tension, to bring three-quarters of a circle of muscle around a tiny tethered mid-philtrum inverted into a dimple and persisted as such. This serendipitous dimple led me to conjecture further on the etiology of the philtrum configuration. Monie was requested to review his bilateral cleft specimens to determine the time of upper labial sulcus formation. The question was whether the prolabium-philtrum is still totally tethered to the premaxilla while the groove and eminences are being formed. Monie explained that his specimens had been cut on the transverse plane to give the best view of the philtrum but unfortunately did not show the labial sulcus.

Latham's research does not seem to confirm the findings of Monie. He wrote in July 1973:

A look at some horizontal sections through the upper lip region of a normal fetus made it clear that the philtral groove is not caused by fibers emanating from the mid-palatal suture. The flared out posterior ends of the medial crura of the alar cartilages do lie in the superior part of the philtral ridge; however, a much more striking and obvious mechanism causing the philtral groove was seen in the arrangement of the labial muscles. The sections show muscle fibers arising from the alveolar bone over the lateral incisor, then coursing anteromedially to an insertion in the medial philtral part of the lip, just beneath the epidermis. This has been confirmed in another specimen sectioned in the sagittal plane.
This readily explains why the lip of a bilateral cleft infant does not retract much when the underlying premaxillary bone is retracted—because there are no muscles in the bilateral cleft lip! This, incidentally, would also appear to support the recent view that muscle should be pulled into the midline. It would be nice if the right muscles could be brought in!

Finally in 1976 Latham, with T. G. Deaton, clarified his latest anatomical findings on the philtrum. What follows is a summary of these findings with some of the illustrations published in the *Journal of Anatomy*.

The course and insertion pattern of muscle fibres in the philtrum of the human upper lip were studied in seven postmortem specimens using serial histological sections and a reconstruction method using sheets of Plexiglas. The fibres of the *musculus orbicularis oris* entering the upper lip from one side were observed to decussate in the midline and proceed to insert into the skin of the opposite side lateral to the philtral groove. The philtral ridges appeared to represent the medial borders of bilateral muscle insertion zones of the lip in which the fibres of the *m. orbicularis oris* raised the level of the skin by splaying out and inserting into it.

Here are horizontal reconstructions of the upper lip musculature of an 18½ week fetus and of a newborn infant.

Contributions to philtral form also came from the *musculus levator labii superioris* as it descended as far medially as the philtral ridge to insert into the vermilion border lateral to the median groove, and from fibres of the *musculus nasalis* which inserted into the philtral ridges superiorly. The philtral groove corresponded to the more compact median decussation of the *orbicularis oris* where lip thickness was also reduced by the relative absence of muscle fibre insertions into the skin. The displacement of the vermilion border giving rise to Cupid's bow appeared to result from the
lifting action of the *m. levator labii superioris* lateral to the median groove in conjunction with a depressor action by the *m. orbicularis oris* on the median tubercle.

Each of these theories could, I suppose, represent the residual effect of the muscleless frontonasal component’s becoming overwhelmed, dimpled and ridged by the inflow of lateral musculature.

**PREMAXILLA**

Woo found from embryological studies that the premaxilla develops from two pairs of ossification centers. The principal pair forms the primordia of the lateral incisors, extends upward and with the maxilla proceeds forward to embrace the premaxilla on either side. This union is complete by the end of the third month.

*Time of protrusion*

In 1954 Stark presented a 60-day-old embryo of 46 mm. with bilateral clefts revealing advanced protrusion of the premaxilla. In 1966 Kraus, Kitamura and Latham presented three interesting embryos that seem to tag the time of protrusion. Their 41- and 43-day-old embryos showed no signs of premaxillary projection, but in their 47-day-old specimen protrusion was beginning to appear. Thus Latham in 1973 concluded that protrusion in bilateral clefts begins at about 45 days (10 days after the original clefting, which occurs at 35 days) and then develops rapidly for
25 days to reach proportions at 70 days (10 weeks) comparable to those seen at birth. Recently he has been working on a 13-week-old bilateral cleft fetus which reveals premaxillary protrusion equivalent to that of the 10-week fetus and in fact similar to that seen at birth. This timing is similar to what he noted in unilateral clefts in his 1969 *Cleft Palate Journal* study.

**Cause of protrusion**

**Bone growth.** There have been numerous theories as to the cause of premaxillary protrusion in bilateral clefts. In 1934 Victor Veau proposed a bone-centered concept of a forward growth force within the developing vomeropremaxillary stem thrusting the premaxillary segment into a protrusion position. Some surgeons have upheld fellow surgeon Veau's belief in the excessive growth between the vomer and the premaxilla. In fact, in 1949 Denis Browne of London demarcated this zone from the quiescent vomer by "a cartilage-filled suture line" and designed his excision for "set-back" in this area of so-called overgrowth.

**Muscle rupture.** Many authorities point to the disrupted facial musculature as an adequate explanation of the cause of this skeletal deformity and thus advocate early restoration of the muscle continuity of the lip as a logical treatment. Pruzansky in 1954 and again in 1964 took this stand. Slaughter, Henry and Berger in 1960 noted the position of the philtrum and premaxilla displaced far anterior to the normal plane and accused:

> This is due to the lack of restraining action of the normally constituted orbicularis oris and its accessory muscles. The unopposed, powerful action of the tongue is then free to exert itself, accentuating the deformity.

In 1967 Fara and Smahel stated:

> The anatomical incompleteness and functional inefficiency of the musculus orbicularis oris in complete bilateral clefts contributes most probably to the formation of a marked protrusion of the premaxilla, manifesting its functional discordance in all the muscles of expression and the disturbance of the harmonious development of the whole middle facial region.

**Cartilage growth.** Others have placed a great part of the responsibility for premaxillary projection on the associated cartilaginous structures.
Patten queried as late as 1971:

The forward growth of the embryonic nose is a relatively late process. If the intermaxillary segment is not properly anchored by the time the nasal growth accelerates, might that be a factor in the way it is carried far out of its normal relations?

Yet it was James H. Scott, Professor of Dental Anatomy, Queen’s University, Belfast, who in 1953 redirected attention to the role of the nasal septum in facial growth. An indefatigable research worker with devastating logic and a dental liberal with a dry Ulster wit, he opened his lectures with

I’m going to speak to you about bone growth but there’s not going to be any newfangled histochemistry in what I say.

Short, stocky, with a big amiable face, he was crippled with rheumatoid arthritis which forced him to teach from a wheel-chair. Even up to the end he bubbled with vitality and cheerfulness, stressing the role of the cranial sutures and pointing to the cartilaginous parts of the cranial base and nasal septum as the pace setter in skull growth.

According to Scott, the growth of the cartilage of the nasal septum acts as the force for growth of the upper facial skeleton in anteroposterior and vertical dimensions. The growing septal cartilage separates the suture lines, permitting new bone growth. It has been said to act as a kind of “epiphyseal plate” for the whole of the upper facial skeleton. This is the mechanism of growth from the latter part of fetal life through the first three years of life. Then for the rest of the first decade sutural growth diminishes as surface apposition and resorption gradually take over.

Another of Scott’s endowments to clefts was the inspiration of ardent students such as Burston and Latham. Burston actually went to Scott for a thesis topic and was given the chondrocranium of the sheep. His work on this subject was later applied to cleft palate. In 1958 he reported the abnormal development following clefting and since then he has created a world-renowned cleft center in Liverpool, England.
LATHAM'S HYPOTHESIS. Under normal circumstances, the bony premaxilla is kept in place by its early fusion with the maxilla to form one bone and by the continuity of mucogingival tissues around the developing dental arch. The development of bilateral clefts creates havoc. Irish oral biologist Ralph A. Latham, originally of Belfast, trained by Scott, stimulated by Burston and now in research at the University of North Carolina School of Dentistry, has put it all together in a logical hypothesis. In 1973, both in the *British Journal of Plastic Surgery* and at the Foundation Cleft Palate Symposium at Duke University, he proposed:

In the bilateral cleft the premaxillary segment is under no restraint laterally either from bone or gingival fibrous tissue; consequently its attachment to the nasal septum by the septopremaxillary ligament becomes a dominant factor.

He also noted that in normal growth, as the nasal septum grows forward, it draws the upper jaw with it, but not at the same rate. In the bilateral cleft, the premaxillary segment is carried forward at the same rate as that of the growing septum to which it is firmly held.

For bone formation to occur at a skull suture, there must be tension between bone edges (Scott, 1948, 1953, 1954; Moss, 1954; Selman and Sarnat, 1957; Pritchard, Scott and Girgis, 1956). The premaxilla united to the forward-growing nasal septum but restrained by the vomer sets up a tension at the vomeropremaxillary suture creating a condition for bone formation. Indeed, the vomeropremaxillary suture is the major site of rigid hard tissue formation and elongation of this segment. Pruzański confirmed this finding in 1971 with serial radiography following placement of metallic implants.

Yet, as pointed out by Latham, premaxillary protrusion is not driven forward by excessive vomeropremaxillary suture growth. Rather, the premaxilla is carried forward by its attachment to the nasal septum through the septopremaxillary ligament. To complete the picture Latham points out:

If bone may not push against bone it appears bone may push against soft tissue! Growth of the maxilla from late foetal life into the early years of
childhood is characterized by bone formation on the upper and posterior surfaces with progressive downward and forward progress of the upper jaw.

ROSS AND JOHNSTON. Orthodontist R. B. Ross, of the Hospital for Sick Children, Toronto, and geneticist M. C. Johnston, of the National Institute for Dental Research, Bethesda, Maryland, expressed a different opinion about the position of the premaxilla in complete bilateral clefts in their 1972 book, *Cleft Lip and Palate*:

The premaxillary segment appears to be tremendously advanced, protruding beyond the tip of the nose. This has often been cited as an illustration of the vigorous growth of the nasal septum and as confirmation of the theory that the cartilaginous nasal septum provides much of the stimulus for maxillary growth [Scott]. . . .

However, the premaxilla is tipped forward . . . and most of the protrusion is due to the forward rotation of the alveolus. The anterior nasal spine (which is a fairly accurate indicator of premaxillary position) is only mildly advanced, although pointing superiorly because of the rotation. Protrusion of the premaxillary segment is probably the result of normal tongue action against a flexible and relatively unsupported bone, without the opposing force of circumoral musculature to establish an equilibrium of forces. The tip of the nose is invariably tilted slightly at birth as a result of the position of the premaxillary segment. The base of each nostril is pulled laterally by the cheek musculature, giving the typical appearance.

**Other aspects of protrusion: actual and relative**

Much of the premaxillary protrusion is due to the abnormally anterior position of the alveolar process, which proceeds as forward alveolar growth for seven to eight months of intrauterine life. The fact that the teeth continue in a normal upright position suggests that the alveolar segment does not actually rotate but by expansion of the dental alveoli reaches a maximum at about four to five months. After that, alveolar protrusion persists as a static feature.

The degree of premaxillary protrusion may be exaggerated by the relative underdevelopment of the unattached maxillary segments, as normal forward development of the early maxillae is to some extent dependent on a forward pull from the nasal septum.
Underdevelopment of the maxilla

Intrigued by maxillary underdevelopment associated with the absence of the cartilaginous nasal septum, J. V. Harvey Kemble studied all such cases under age 20 years seen at Queen Mary’s Hospital, Roehampton, London, in the past 10 years. The total was eight—three congenital, four traumatic and one unknown.

Kemble acknowledged three theories on the development and growth of the maxilla:

2. Latham’s theory that the maxillae have inherent potential for growth which does not depend on outside influences (1968).
3. Sarnat’s experimental findings that the normal nasal septal cartilage growth is necessary for full maxillary development (1963).

As Kemble concluded that his clinical findings confirmed theory 3, it is of interest to review his abstract of Sarnat’s work:

Sarnat (1963, 1966) . . . deduced from experiments of extirpation of circum-maxillary sutures in monkeys and in rabbits, that because little or no deformity resulted when compared with controls, growth which occurred at sutures was of a secondary accommodating nature. Furthermore, he showed that extirpation of the cartilaginous nasal septum from growing rabbits produced smaller nasal and maxillary bones than in controls. The extent and severity of the deformities varied approximately in proportion to the amount of septum removed. Removal of cartilaginous septum from full-grown rabbits did not result in collapse of the snout, so that it seemed unlikely that it was lack of support that produced underdevelopment of the snout in growing rabbits (Sarnat 1967). From these experiments it would seem likely that the cartilaginous nasal septum is primarily responsible for forward and downward growth of the maxilla, and that growth at sutures maintains and consolidates its position, at any rate in experimental animals. The fact that Stenstrom (1970) found only minor deformities resulting from removal of septal cartilage from young guinea-pigs can only be explained on the basis of a species difference.

Latham’s Irish reaction, in November 1973, to this stand is rather provocative:

There is good evidence that the nasal septum is an important determinator
of upper facial growth in the embryonic and fetal periods. Individuals with impairment of the nasal septum usually show underdevelopment of the upper jaw at birth. . . . It is obvious that the human face is capable of growth after birth in the absence of the nasal septum. . . . There must be a considerable period before and after birth into childhood when nasal septum stimulus and intrinsic maxillary growth are complementary and working together. . . . There is a tendency for writers on this subject to want one mechanism to do the whole job. Kemble appears to think of three mutually exclusive mechanisms, each making their main contribution at a different time in a sequence. . . . Kemble’s conclusion, however, is fair enough. It seems that the septum does make an important contribution both in growth and in structural support to the upper jaw and in its absence full maxillary growth will not be realized.

Latham, in conclusion, warned of the danger of evaluating maxillary underdevelopment as measured by the sella turcica-nasion-anterior portion of maxilla angle.

The septum, premaxillary bone and teeth all appear to come from the neural crest cells in the young embryo and if the septum is absent, the incisor teeth and bone are likely to be absent too. Such is the case in cyclopia and rhinencephaly. Then the SNA angle could be low because of the absence of these structures suggesting more underdevelopment of the middle third of the face than is actually present.

*A combination of factors*

Actually the premaxillary projection deformity must be the result not of one factor but of the interrelation of many factors—lack of bony continuity, growth at the suture, cleft of the orbicularis oris muscle, forward growth of the cartilaginous septum and expansion of the alveolar process.

**THE NOSE**

With the bilateral cleft deformity, the entire nose is deficient. In 1973 Stark and Kaplan reported tracing two bilateral cleft embryos to measure the ectodermal volume ratio of the primitive nose. They found extremely small measurements of 8.1:7.9 cubic cm. for the 40.5 mm. embryo and 12.1:10.8 cubic cm. for the 46 mm. one. These findings exhibit the great deficiency of ectoderm in the bilateral cleft lip nose, a horrendous lack of nasal germ plasm.
WHATEVER HAPPENED TO THE BABY COLUMELLA!

In 1974 R. A. Latham and C. Workman noted, in Georgiade and Hagerty's volume on the transactions of the Cleft Lip and Palate Symposium held at Duke University:

In the bilateral cleft condition the anterior nasal spine nestles between the flared out ends of the medial crura. The present interpretation is that the spine is too far forward, not that the crura are too far back.

The premaxillary bones are clearly set farther forward on the nasal septum than normally. However, a large part of the problem with the columella is due to the forward expansion of the alveolar process beneath the medial crura of the alar cartilages.

Latham blames the total clinical absence of the columella primarily on failure of differential growth and secondarily on the invasion of the columella area by the forward growing and expanding alveolar process.

Normal development of the columella is dependent upon the fact that the anteroposterior dimension of the cartilaginous septum increases at a faster rate than the vomer and premaxilla, thus pulling an elongation of the columella and shoving a projection to the nasal tip. Latham explains it this way:

When bilateral clefts divide the primary palate, the counterbalance on the septopremaxillary ligament is vastly reduced. The septopremaxillary ligament then exercises a dominant influence on the premaxillary bones, which are held tightly to the anteroinferior border of the nasal septum. This would account for the forwardly placed basal part of the premaxillae. The forward growth differential between the nasal septum and premaxillary bone fails.

Thus, the loss of columella is due directly to the lack of this differential growth between the septum and the premaxilla. The nasal tip and its cartilages also must suffer the consequences. Like a tent without the insertion of its front pole, the nasal tip never rises, leaving the angle of its alar cartilages flattened and the feet of its medial crura splayed.

As further proof that the premaxillary segment persists in an embryonic relationship to the nasal septum in bilateral clefts, Latham found Jacobson's organ as a pit in the septal mucous
membrane not in the full-term normal position *anterior* to the alveolar process but rather *above* and *behind* it.

When, in addition, the developing alveolus bulges forward during gradual anterior expansion of the incisor teeth and alveolar process to encroach upon the columella base, there is further obliteration of this nasolabial angle. The swindled columella is left relatively as well as actually destitute!
2. Bilateral Cleft Anatomy

In a single cleft, the premaxilla is normally attached to the maxilla on one side and this entire component is rotated outward varying degrees from the cleft side maxilla in an asymmetrical distortion. Double clefts present an entirely different configuration. In the complete bilateral cleft the premaxilla is unattached to either maxilla; thus there are three separate components which are more or less symmetrical in their distortion. The two maxillae are usually equal to each other in size and position while the central premaxillary element proceeds forward on its own, in different degrees but with symmetry within itself except for possible deviation.

The complete separation of the central frontonasal component of prolabium and premaxilla from the lateral maxillary segments abnormally influences the nose, philtrum, musculature, vascularity, nerve supply, growth and development of all three elements.

Where the cleft is incomplete on both sides, the deformity is less and is still symmetrical. In such a case there is usually a more or less intact alveolus and little or no protrusion of the premaxilla. The columella is likely to be longer than in the complete cleft but not of normal length.

Sometimes the degree of cleft varies on each side. Sometimes the incompleteness shows as only the slightest notch on one side
and a halfway or three-quarter cleft on the opposite side. Or there can be a complete cleft on one side and an incomplete one on the other, which condition exaggerates the exasperating aspect of asymmetry not only in the lip and nose but in the rotation of the premaxilla. The existence of some attachment on one side helps, of course, to check the uninhibited central projection of the premaxilla.

Even the most minor unilateral synechia working during the prenatal and postnatal period can curb some of the explosive thrust of the premaxilla, appreciably reducing its protrusion. Veau sketched and commented on this in the 30's. Here is a case that demonstrates modest restraint by a tiny Simonart's band.

SIMONART'S BAND

While at Rooksdown House, Basingstoke, England in 1948-1949, I learned to refer to residual congenital skin bridges spanning the upper portion of lip clefts as Simonart's bands. Holdsworth later referred to them as Simonartz bands. In recent years a search has been underway to discover the origin of this mysterious sobriquet. In 1976 Tom Gibson, intrigued by these terms, found that Gustav Simon in his 1868 book had presented an adhesion-type operation for bilateral clefts (Chapter 13) and deduced that someone subsequently must have written about repositioning of the premaxilla by creating the transverse bands of "Simon Arzt in Rostock." This would be an operative band, not a congenital one. Meanwhile I turned to S. Anthony Wolfe and he turned to Sam Pruzansky who forwarded two lead references. Simonart: "Note sur les Amputations Spontanées," Journal
des Connaissances médicales, June 1846, pp. 327-330, also Archives Médicales Belges, 1846, pp. 112-119. With these references Tony Wolfe wrote Richard J. Wolfe, Rare Books Librarian, Francis A. Countway Library of Medicine, Harvard Medical School, who sent photocopies of the first Simonart article. Then Tony Wolfe wrote his friend Michael Meesen, Liège, for information on Simonart and received a notice obtained from a Belgian registry which indicated there was a man named Pierre-Joseph Cécilien Simonart, professor agrégé at the University of Brussels, born in Wavre, May 20, 1816, died Wavre, December 19, 1846, age 30.

Simonart had been previously discussing cases of spontaneous amputations and deep grooving of the extremities due to encirclement by either umbilical cord or by amniotic bands. After reviewing the previous cases in the literature, he mentioned an interesting type of lateral facial cleft case seen in Brussels. Here are excerpts from his paper, “Notes sur les Amputations Spontanées” in Journal des Connaissances médicales pratiques et de pharmacologie, June 1846, pp. 328-329, presented in the original French and translated into English:

Chez un fœtus recueilli, il y a peu de temps, à la Maternité de Bruxelles, la joue de chaque côté, à partir de la commissure labiale, est comme coupée dans toute son épaisseur par une bride de cette espèce, qui remonte vers l’occiput.

In a fetus obtained not long ago at the Maternite of Brussels, the cheek on each side, from the labial commissure, was cut in all its thickness by a band of this type which extended up to the occiput.

Later in his article he queried whether the amniotic bands represented intrauterine inflammatory processes. He also stated:

Les parties molles souscutanées sont déjà séparées et quasi coupées, que la peau reste encore intacte: celle-ci n’a subi qu’un léger amincissement.

The subcutaneous soft tissues are already separated and almost divided with the skin remaining intact: it has undergone only a slight thinning.

Thus it seems that as Simonart did indeed refer to congenital skin bridges in the area from the labial commissure and cheek to the occiput, over the years the name Simonart’s bands somehow became associated with residual skin bridges crossing the upper portion of lip clefts.
In 1954 Summerfield King described the anatomy of the bilateral deformity as two deep clefts continuous with the nostrils which separate a median tubercle from the paired lateral elements of the upper lip. The premaxilla has two large bulges containing the incisor teeth and the bone related to them. A narrow median ridge, the frenulum, attaching the premaxilla to the prolabium is formed of connective tissue covered by a thick, uncornified stratified epithelium. The inferior frenulum continues into a broad V-shaped red lip margin of the prolabium with fibrous connective tissue very richly vascularized. Its epithelium has a thin stratum corneum without glands or hairs. Between the red lip margin and the gum there lies, on either side, a narrow strip of mucous membrane with an uncorumified type of stratified epithelium of moderate thickness represented as everted posterior surface of lip. The epithelium of the sulcus between prolabium and gum is similar but thinner. Superior to the red margin in the prolabium is a triangular or circular area covered with hairy skin. Near the red lip margin (mucocutaneous junction), although the epithelium is still clearly of ordinary skin type, hairs are scanty or absent.

The median tubercle contains the right and left premaxillae united by a median suture. Each premaxilla is enlarged laterally to carry two incisor teeth, a central incisor looking inferolaterally and a lateral incisor at a higher level looking posterolaterally. Their sockets are shallow, a great part of the tooth roots being covered only with soft tissue.

Extending posteriorly as an extension from the premaxillae is the subvomerine process, which produces a groove. In this rests the cartilaginous nasal septum and the long, narrow vomer.

The maxilla is represented on each side by a shallow alveolar process containing some milk teeth and by a frontal process and a pair of minute palatal processes. But there is no maxillo-premaxillary (incisive) suture, for the bones are widely separated.
LIP ANATOMY

Prolabium

The prolabium is the soft tissue end point of the frontonasal component. It may vary in size from a few millimeters to over a centimeter in height and width. In bilateral cleft it has been tragically shortchanged, possessing no cupid’s bow, no philtrum dimple, no philtrum columns and no labial sulcus and is attached to little or no columella. And that is not all this little patch of skin and mucosa is lacking. The soft, flat prolabium sitting forlornly on the front of the unrestrained, aggressive premaxilla is evidence that muscle migration from the maxillary processes has not reinforced this minimal bit of the frontonasal process.

Muscle discrepancy

As noted intermittently by Mullen, Veau, Lee, Burian, Davis, Stanek, King, Stark, Ehrmann, Rees, Swinyard, Converse, Fara, Smahel, Latham, Duffy and others, there simply are no muscle fibers in the prolabium of complete bilateral clefts, although they are plentiful in the cheek and over the side of the nose. Muscle fibers are, however, found in the prolabium of incomplete bilateral clefts, and the amount varies inversely with the degree of the clefting—the less severe the cleft, the more muscle in the prolabium. These findings seem compatible with the mesoderm migration and merging theories.

In 1931 Mullen expressed suspicion that there was not any muscle, and in 1946 Lee documented the absence of muscle in the prolabium. In 1958 Stark and Ehrmann recognized that the prolabium contained normal mesoderm but without muscle.

It is interesting how “mod” Thomas Rees, son of a Mormon professor of biology at the University of Utah, got interested in the muscle of the prolabium. About 1955, while training with McIndoe at East Grinstead, Rees operated on a 15-year-old Irish boy with a complete bilateral cleft. The prolabium was so attenuated that he used it for columella, noting its absence of muscle. The following year McIndoe took Rees with him to his great wheat farm on the northern slope of Kilimanjaro, East Africa, and during this trip McIndoe, Rees and Michael Wood started a
plan that was later to develop into the Flying Doctors of East Africa. During other trips to Africa, Rees operated on two other adult bilateral clefts with attenuated prolabiums. As he wrote recently,

These three cases later stimulated me to look into the problem of muscle in the prolabium.

In 1962, with Swinyard and Converse, he reported electromyographic evidence of absence of muscle activity in the prolabium.

**Histological picture**

In 1967 Fara and Smahel made some deductions from the study of 330 cases of complete bilateral cleft lips operated on in recent years. Only 3 percent of the bilateral cases were clefts just of the lip and alveolus, and none were clefts of the lip alone. Their microscopic sections of the prolabium of stillborns and children five to seven months of age revealed concurrence in Veau’s original assertion that the prolabium suffers from muscular “sterility.” They noted no striated muscle fibers whether differentiated or in various stages of differentiation.

**Orbicularis oris muscle fiber direction**

In 1960 Wayne B. Slaughter, J. W. Henry and J. C. Berger of Loyola University, Chicago, noted that the muscular components in clefts do one of several things:

(1) Either they terminate in a rather indiscrète fashion leaving sarcolemma with vague unclear components present, or (2) they fade into connective tissue, or (3) the muscle fascicles predominantly turn toward the nostril.

In 1966 Pennisi, Shadish and Klabunde noted this same orbicularis oris muscle disorientation with its peripheral fibers running parallel to the edges of the cleft.

As early as 1965, Fara and Hrivnakova mentioned that the orbicularis oris muscle fibers parallel the cleft edges in incomplete
By 1967, along with reemphasizing the lack of striated muscle in the prolabium, Fara and Smahel noted immature, fine, collagenous, connective, felt-like tissue and a rich vascular network. In the lateral lip segments they found:

The muscle bundles run along the edge of the cleft, turning upwards . . . towards the line of the nasal wing where they nearly all disappear in the submucosal layer. Only rarely do the muscle fibers show a tendency to advance in a horizontal direction.

Further evidence was presented in 1968 by Fara, who reported the dissection of one bilateral incomplete and six bilateral complete clefts of the lip. He noted the same upward direction of the muscle fibers running parallel to the cleft edges in the lateral lip segments and the same vascular networks coursing along the edge as found in unilateral clefts. The prolabium of complete clefts, although possessing a rich vascular network, had no muscle and only collagenous connective tissue. In one incomplete bilateral cleft the muscle of the lateral segment crossed the bridge of the cleft quite smoothly into the medial lip prolabium, completely filling it. Fara, fortified with 28 excised bridges from bilateral incomplete clefts, reported them well filled with muscle fibers penetrating from the lateral segments into the medial prolabium and spreading open like a fan. He conjectured that the prolabium, partially isolated by the clefts and originally without any muscle fibers, directly absorbed the necessary tissue from the lateral richly muscled elements.

R. B. Ross and M. C. Johnston, in their 1972 book Cleft Lip and Palate, simplify the muscle anatomy in bilateral clefts:

The cleft of the lip has considerable influence on the myoblasts moving into the lip from the hyoid arch muscle plates. In the lip those myoblasts which will form the orbicularis oris encounter the cleft margin and turn upward toward the base of the nose either at the alar wings or in the anterior nasal spine region where they eventually form their attachments. This phenomenon suggests that myoblasts will not differentiate into mature muscle cells unless they find a skeletal or connective tissue structure to which they can attach.
Muscle anatomy in bilateral clefts

The fibers of the orbicularis oris muscle in each lateral lip element sweep up along the cleft edge toward the alar base. The lack of muscle continuity across the lip places the lateral elements at the mercy of the accessory muscles through the modiolus.

In incomplete bilateral clefts the orbicularis oris muscle fibers run parallel to the lateral lip edges but manage to sneak some fibers through the skin bridges which then fan out into the prolabium. With smiling and crying the lateral lip elements are partially restrained by the bridges, and the prolabium flattens and stretches from side to side at least to some extent.

In this bilateral incomplete cleft lip the bridges are so attenuated that very little muscle has been able to migrate across the clefts. Yawning therefore leaves the prolabium almost totally unperturbed.

In complete bilateral clefts the orbicularis oris muscle fibers in the lateral lip elements run parallel to the cleft edges toward the alar bases. The prolabium itself has absolutely no muscle. During expression of emotion by laughing and crying, while the lateral lip elements are jerked without restraint upward and backward by the unopposed accessory muscles, the prolabium sits solemnly on the premaxilla wholly unaffected.

Sensory nerves

In bilateral clefts the long sphenopalatine nerve passes down on each side of the vomer supplying its mucous membrane and that of the premaxilla. The anterior ethmoidal nerve passes vertically
Incomplete cleft

Complete cleft
down dividing into a medial division to the septum and a lateral division to the fossa anterior to the nasal concha, the upper part of the medial tubercle and the frenulum. The infraorbital nerves, besides splaying out to supply the cheek, give off two large trunks which cross the face to the side of the nose and arch inferiorly over the ala to reach the columella, where they form neurovascular bundles with divisions of the facial artery traversing the columella-philtrum region. The incisor teeth receive no nerve supply; this lack may account for their early insecurity.

Motor nerves
The branches of the facial nerve follow the distribution of the muscles but do not spread quite so far. As they approach from the sides, they are not affected by the cleft, except of course they do not cross the complete cleft. There is no muscle to serve in the totally isolated prolabium anyway. In incomplete clefts with varying amounts of muscle coursing the bridges into the prolabium a terminal nerve twig may sneak across if there is enough muscle to carry and merit it.

Vascular patterns in bilateral clefts
In the bilateral cleft specimens studied by Summerfield King in 1954, the right facial artery gave a descending branch to the ala and another branch to the dorsum of the nose but took no part in the supply to the medial tubercle. The left artery formed a horizontal arch which crossed the lower part of the nasal bone and then split as it reached the midline into two divisions that passed down the dorsum of the nose side by side to the philtrum region. Here each division gave a branch that wound over the body of the premaxilla to reach the shallow alveolus of the lateral incisors and entered the pulp. The two divisions then passed along the attachment of the frenulum and ended supplying the medial incisor teeth. They finally anastomosed with the sphenopalatine artery. The veins accompanying the arterial trunks were plexiform in arrangement with intercommunications.
Wayne B. Slaughter with pathologist James W. Henry and Jack C. Berger in 1960 in *Plastic and Reconstructive Surgery* compared the vascular patterns of normal people with those of four human specimens with clefts and serial microscopic sections from 20 cleft infants. They noted:

In the complete bilateral cleft the superior labial artery fails to unite with its fellow from the opposite side and contributes nothing to the blood supply of the philtrum. In addition to this, the arcade made up by the anastomosis of the posterior septal branch with the greater palatine artery through the incisive foramen is absent. The philtrum and premaxilla must, therefore, derive their blood supply from the posterior septal artery and to a lesser extent from the lateral nasal and terminal branches of the anterior ethmoid vessels which pass through the columella.

Dissection of cleft specimens indicate that there is usually one well differentiated vessel on either side of the premaxilla in the region where the incisive foramen should have been. Each of these vessels passes anteriorly and inferiorly into the philtrum. Within the philtrum they continue inferiorly and medially in an arc to anastomose across the midline in the inferior portion of the philtrum.

Dissection of the lateral segments in cleft specimens shows the superior labial artery arising in approximately normal fashion from the anterior facial artery at the level of the angle of the mouth. Being unable to pass horizontally through the lip because of the cleft, it passes superiorly and medially to a point approximately at the level of the lateral inferior attachment of the alar cartilage. Here it forms an effective anastomosis with the lateral nasal artery. This continuation of the superior labial artery probably represents the ascending septal branch which in the normal individual anastomoses with the anterior extension of the posterior septal artery.

In the areas immediately adjacent to the cleft, the normal mature vessel patterns are no longer present. Instead there are embryonal vessels having both venous and arterial characteristics of varying degrees. Although the vessel pattern is undifferentiated there is a tendency for most of the vessels to run parallel to the cleft.

The bilateral cleft vascular pattern here portrayed with several corrections is drawn from the research of Slaughter, Henry and Berger.
In 1968 Fara, using arteriography in one bilateral incomplete and six bilateral complete clefted mature stillborns, found poorer blood supply in the cleft sides of the philtrum but always a rich vascular central network starting in the septal and columellar arteries. In the lateral elements the arteries generally ran along the edges of the cleft, turning upward parallel with the course of the muscle bundles. In the lateral side they were usually stronger and formed denser networks than on the philtrum side.

**Bilateral Nasal Deformity**

In the normal person the premaxilla is held within the maxillary arch so that the growth thrust of the septum is cushioned in part by the anchoring of its union in the arch. The septal growth kick is responsible for forward growth of the maxillary arch, but its forward progress is not as great as that of the septum itself. The point of the septum is carrying the *tip of the nose* along with each *angle* of the medial and lateral crura of the *alar cartilage* and the *columella*. The proud advance of these structures is evidently dependent upon the distance the septum projects beyond the
premaxilla. Under these circumstances it might be conjectured that the most progressive nasal development is exemplified in the narrow high-bridged noses seen in British actors often playing the role of a butler, or even in the Middle East nasal humps and high nasal roots. By the same deductions the nasal flatness of the African Negro and the Oriental could represent a back step in nasal progress. It is interesting that in the nineteenth century reduction rhinoplasty was conceived and for over a century has been used and modified to produce noses that are neither too high nor too low but stand between these extremes.

In the complete bilateral cleft the premaxilla "hangs in under there neck and neck" with the septum, preventing the septum from going ahead. The effect of this lack of discrepancy on the nose is equivalent to what happens to a tent that never has its front center pole inserted. It appears to have fallen "flat on its face" when actually it has never gotten "off the ground" in the first place. Not only is the nasal tip flat, but the medial crura of the alar cartilages are left separated, their angles spread, and the columella, being unstretched, is almost nonexistent.

SPREAD OF THE NASAL BASE

The clefts through both nasal floors and the maxillary platform also have a devastating effect on the nasal base. Again, it is like a tent without its center pole, precariously pitched over two chasms of different widths with the central peninsula set at higher ground but varying in the height of its rise and the degree of its lean to one side or the other. The lack of integrity of the nostril and its sill sets the alar bases free to flap like unattached tent sides. Then, with the constant pull of the unopposed lateral lip musculature, the flaring and eversion of the alar bases are exaggerated and the shape, thickness and set of the alar wings are provokingly abnormal.

ALWAYS AN EYE ON THE NORMAL

The anatomy of the normal has been discussed in detail in Volume I, Chapter 2, but it is always a pleasure to review the
beauty of the normal and essential in order to use it as a guide in planning treatment and grading results.

Wise old owl Ivy, while shaving one morning in 1967, noted the conformation of the philtrum:

One has only to glance at one's own upper lip in the mirror to establish the fact that the midline vertical groove or philtrum is due to an interruption of continuity or direction of some of the orbicularis oris muscle fibers in this area, and that the orbicularis oris is not a simple sphincter like the orbicularis oculi. A rough measurement shows that, with the adult upper lip at rest, the total thickness of the lip laterally is about 11 mm., whereas in the central vertical groove it is about 7 mm. because of the absence of about 4 mm. in thickness of orbicularis oris muscle at this point.

Particularly pertinent normal anatomical aspects that have gone astray in the bilateral cleft deformity and must be sought, corrected or created are as follows: (1) an intact alveolar arch with teeth in occlusion, (2) a lined upper labial sulcus, (3) intact orbicularis oris muscle continuity with its fibers running in horizontal direction, (4) a central philtrum dimple, (5) symmetrical philtrum columns embracing the dimple and curving toward the columella to join each other below it or at its base and seldom running into the nasal floor, (6) a cupid's bow, (7) a midline vermilion tubercle, (8) a "white roll" lighted ridge topping the mucocutaneous junction of the upper lip, (9) an upper lip short enough in vertical length at rest to expose the lower third of the central incisors and with smiling and laughing more of these teeth until all is seen, (10) width of the philtrum less than one-quarter the width of the lip from commissure to commissure, (11) normal relation of upper lip in anterior eversion to lower lip, (12) an elevated slender nasal tip, (13) a graceful relatively elongated columella set at a natural nasolabial angle of 90 to 120 degrees, (14) symmetrical alar rims, (15) unflared alar bases turning in to form nostril sills across the front of intact nasal floors, and (16) bilateral patent airways. And all of these should be in proportions consistent with the specific age, race and sex.
NORMAL MEASUREMENTS OF NOSE AND LIP

Farkas and Lindsay measured 100 normal young Canadian adults, 50 males and 50 females, and found that columella length ranged from 16 to 10 mm. with a mean of 12.3 in the male and from 15 to 9 mm. with a mean of 12.2 in the female. They also found that the vertical length of the upper lip ranged from 18 to 26 mm. with a mean of 22 in the male and 16 to 24 mm. with a mean of 19.6 in the female. These findings correspond with those of HajnisoVA on central Europeans and of Hajnis on western Europeans.

Clifford and Pool reported in 1959:

The lips of 100 normal infants and children under the age of 5 years were measured. The vertical height was taken from the base of the nose to the peak of the cupid's bow at the white line of the vermilion. The average vertical height of a 1-month-old infant was 10 mm. At the age of 3 months this distance was 12 mm. At the age of 1 year the vertical height was 13 mm. A group of 50 adults was measured and their average vertical height was 17 mm. The adult lip, therefore, is only 5 mm. longer than the average child of 3 months of age. Surprisingly, many adult lips of normal appearance were only 13 mm. in vertical height.

Brauer, at the 1973 Duke Symposium, set the Cupid's bow width at about 4.5 mm. and the vertical lip height at 9 mm. or more in the infant.

Resident Tony Wolfe added further normal measurements of Americans to those of Gaston Schwarz to form this general guideline. It corresponds closely to the figures of all other investigators.

The comparison of the bilateral cleft deformity with the normal can be shocking and humiliative but the discrepancy must be taken as a challenge. It may not always be possible to achieve the ideal normal, for not even all normal lips and noses can be made truly beautiful. Yet our goal must be to mend these lips and noses so that their faces are not only in balanced proportion and attractive but capable of the gamut of expression, from the composure of the Mona Lisa to the joy of the Laughing Cavalier.
Male—Normal

Long lip
Short lip
Thin lip
Long columella

Flared alae
Thick lip
Strong mucocutaneous ridge

Narrow philtrum

Lower lip dimple would make fine philtrum (Abbe!)
Strong white roll
Narrow nose

In the nobility of age, the depth of lip wrinkles challenge the philtrum groove and run in the same direction.

Long lip
Medium columella

Wide philtrum
Short columella

Four long philtrums
Female—Normal

Smiling a soft bow

Strong tubercles and white rolls

Strong

and

Long philtrum
dimples

Lower 3/4 of incisors exposed at rest

Wide nostrils

1/2 exposed with smile

Strong bow

Minimal bows and shallow dimples

All is shown with a laugh
## Averages in cm.

<table>
<thead>
<tr>
<th>Age</th>
<th>Small Newborn</th>
<th>Normal Newborn</th>
<th>5 Years</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Caucasian</td>
<td>Negro</td>
<td>Caucasian</td>
<td>Negro</td>
</tr>
<tr>
<td>Race</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nose 1. Columella height</td>
<td>0.5 (0.3-0.6)</td>
<td>0.4 0.4 0.3 0.3</td>
<td>0.7 0.6 0.5 0.5</td>
<td>1.3 (1.0-1.3)</td>
</tr>
<tr>
<td></td>
<td>2. Columella width</td>
<td>0.4 (0.3-0.5)</td>
<td>0.4 0.4 0.4 0.4</td>
<td>0.6 0.6 0.5 0.6</td>
</tr>
<tr>
<td></td>
<td>3. Nasal width</td>
<td>2.0 (1.7-2.1)</td>
<td>2.2 2.3 2.5 2.4</td>
<td>2.7 2.5 3.4 3.6</td>
</tr>
<tr>
<td>Lip 4. Vertical height (alar base to high point)</td>
<td>0.7 (0.6-0.8)</td>
<td>1.1 1.0 1.1 1.2</td>
<td>1.4 1.3 1.7 1.5</td>
<td>2.0 (1.3-2.2)</td>
</tr>
<tr>
<td></td>
<td>5. High point to commissure</td>
<td>1.4 (1.2-1.5)</td>
<td>1.5 1.5 1.6 1.5</td>
<td>2.3 2.3 2.3 2.1</td>
</tr>
<tr>
<td></td>
<td>6. Cupid's bow width</td>
<td>0.6 (0.5-0.8)</td>
<td>0.7 0.7 0.8 0.6</td>
<td>1.0 1.0 1.1 0.9</td>
</tr>
<tr>
<td></td>
<td>7. Commissure to commissure</td>
<td>2.6 (2.2-2.8)</td>
<td>3.3 3.5 3.8 3.0</td>
<td>3.3 5.2 5.3 5.1</td>
</tr>
<tr>
<td>Total number of cases</td>
<td>10</td>
<td>20 15 20 12 20 20 20</td>
<td>40 40 30 30</td>
<td></td>
</tr>
</tbody>
</table>


In this deformity there are two clefts with double the varying amounts of missing composite tissue, bone, muscle, skin and mucosa. There is shortness in the vertical length of the entire frontonasal component from the nasal tip to the mid-inferior edge of the prolabium vermilion, the discrepancy being most noticeable in the length of the columella and prolabium. There is more than double the number of absent landmarks and double
the amount of disarrangement of what anatomy is present. There is no vestige of the normal cupid's bow, philtrum dimple and columns and nostril sill with which to compare or imitate; in fact, vestiges even to preserve are minimal.

In the vernacular: "It's a hell of a mess!"

THE VARIATION IN BILATERAL CLEFTS

In the bilateral incomplete cleft there is usually more tissue present, less distortion of the maxilla and the helpful aspect of symmetry. In the mixed bilateral with a complete cleft on one side and an incomplete cleft on the other, most of the discrepancies suffered by bilateral clefts are usually present but in addition there is the difficult aspect of asymmetry. In the bilateral complete cleft the deformity is at its zenith irrespective of the one favorable quality of symmetry for, as one might say, "It is better to have one of something than two of almost nothing."

IN THE COMPLETE DOUBLE CLEFT

The nose is flat and flared, lacking in the beauty of proud tip projection, graceful alar flow and nostril curve. The columella is short or absent so that the nasal tip is dragged down into the lip. The lip not only has no continuity but is actually divided into three parts.

The central portion or prolabium is thin, totally expressionless
and often convex in contour. It is round in shape and can vary in size from a minute (millimeters) nubbin to a large (centimeters) Ping-Pong paddle. It is composed of skin in front but is plastered to the premaxilla behind with little or no labiogingival sulcus. There is subcutaneous tissue in varying amount but no muscle present. Except where it is attached to the tip of the nose, the prolabium is bordered by a mucosal edge different in color and texture from the lateral lip vermilion. The mucocutaneous junction of the prolabium, running around the edge as a half circle or U, is so vague as to be difficult to discern and often sports no true “white roll” ridge, which is pronounced on the lateral lip elements.

The lateral lip elements vary in size, often being far longer in vertical dimension than the prolabium. Since they are attached to the retroposed maxillae, they are placed in a backward anteroposterior plane in relation to the prolabium. The alar bases join the lip elements in an abnormal direction. The vermilion of the free border is full laterally but thins out along the cleft. The mucocutaneous junction is vague along the cleft but rises into a true light-reflecting ridge laterally.

Although the lateral elements carry the only muscle in the lip, the arrangement is far from normal. There is often a groove of deficiency above near the join with the nose and a swell below where the muscle bulges in disappointment. The muscle fibers sweep from the bulge parallel along the cleft edge toward the nose. Lack of integrity of the muscles across the cleft places the lateral lip elements at the mercy of the accessory muscles through the modiolus. Smiling or crying pulls the sides of the lip up and back, widening the gaps and exposing normal and abnormal oral architecture, cleft alveoli, septovomer stalk, palate halves, tonsils and adenoids.

And out of all this distortion rises the premaxilla like a prehistoric reptilian head demanding priority. Through the ages the amount of projection of the premaxilla has had a great practical influence on how the surgeon has dealt with bilateral clefts of the lip. It is no mean feat, even today, to achieve a successful closure of both clefts at the same time if the premaxillary protrusion is severe.
Premaxilla projecting

Excision
- Primary
  - Total
  - Partial
- Secondary
  - Total
  - Partial

Extraoral traction
- Headcap
- Fixed
- Cloth
- Elastic
- Prosthodontic assistance
- Intermaxillary wire and elastic band
- Prosthodontic assistance

Closure of lip
- Adhesion
- Muscle union
- Two stages
- One stage

Premaxilla after recessed in undercorrected position or nonprojecting
- Edges freshened
- Mucoperiosteal flap closure
- Bone graft
- Periosteal flap (boneless bone grafting)

Setback
- Compression fracture, Ugh!
- Subperiosteal oblique section and sliding
- Resection of suture, Ugh!
- Subperiosteal resection of prevomerine area
- Subperiosteal resection of vomer posterior to suture
- Toothed bar
- K-wire
- Keith needle
- Horizontal septal incision
- K-wire
HAMLET, Shakespeare's Prince of Denmark, having lost his father, seen a ghost and discovered a heinous crime, cried out in anguish with what might well become a plastic surgeon's ode to the projecting premaxilla:

The time is out of joint: O cursed spite,
That ever I was born to set it right!
Nay, come, let's go together.

No apologies are offered for the size of this chapter. Without a doubt the ominous shadow cast by the projecting premaxilla over its flanking maxillary segments and the obliteration of this shadow by the ultimate alignment of the "triplet" is the number one problem in cleft lip and palate surgery today. A review of the literature reveals what appears to have been and still is a frantic effort to equalize a giant and two dwarfs of the same age with anything available—mallet, rubber bands, chisel, saw, scalpel, plates, mechanical squeezers, muscles, growth and time. Yet it is essential to know what has been tried in order to know not only what to do and not to do but what is left still to be tried.

In bilateral clefts the position of the premaxilla is the keystone to the reconstruction. If it rests within the maxillary arch, closure of the lip clefts offers no great problem. This is the usual situation in incomplete bilateral clefts. In complete bilateral clefts, however, the premaxilla invariably extends in front of the premaxillary elements, and the projection can vary from insig-
significant to almost insurmountable protrusion often associated with deviation. This projection has been treated in numerous ways over the centuries.

**PRIMARY EXCISION**

Pierre Franco, a pioneer in cleft lip surgery, was the first to describe discard by primary excision of the projecting premaxilla in bilateral clefts. He also advocated surgical freeing of the lip elements off the maxilla to aid in the closure. In 1556 he wrote:

There is another type of cleft lip which is commonly called hare's tooth because there are teeth which protrude from the mouth in front of the maxilla, sometimes only one, more often two. And sometimes [they are] also accompanied on both sides by clefts of the maxilla. As for the method of treatment . . . when these teeth or mandibles are so large that they cannot be covered, there is no danger in cutting off the excess with a cutting forceps or with a small saw, leaving the flesh over them [prolabium] if there is enough: for it will be possible to sew the margins to it [the prolabium] on each side. And if the distance between the margins was so great that they could not be joined, it would be necessary to use incisions within the mouth [to undermine lip elements from their attachments to the maxilla].

In 1661 Hendrik Van Roonhuzze of Amsterdam advised cutting away with pincers the projecting premaxilla in “hare-mouth” so as to permit suturing of the bilateral cleft lip.

Georges de la Faye of Paris in 1733 removed the projecting premaxilla with scissors which had long blades and were made like a watchmaker's chisel.

**Dupuytren**

Guillaume Dupuytren of Paris, known by some as the Napoleon of surgery, was also a pioneer in plastic surgery. He was 130 years ahead of Moyer with nitrate of silver in burns, 20 years ahead of Langer with lines of skin tension, 10 years ahead of Curling with his gastrointestinal ulcer and ahead of almost everyone on the contracture of the palmar aponeurosis. He also enjoyed self-aggrandizement, allowing his name to be attached to a powder to reduce “itch” and an ointment against baldness and even managing to get King Louis XVIII to make him a baron in 1816. Yet even his jealous enemies had to admit he was a hard worker. As Goldwyn noted, Monsieur le Baron would be seen still
making rounds on the wards at nine in the evening, "sloppily attired in an old green frock and socks over the tops of his boots," followed by an entourage of students and visitors from all parts of the world.

His contributions in bilateral cleft lip surgery were less remarkable for he showed the same impatience with the projecting premaxilla that he did with a troublesome patient. According to Dupuytren's American student, Jonathan Mason Warren:

If his orders are not immediately obeyed, he makes nothing of striking his patients and abusing them harshly! A favorite practice of his is to make a handle of a man's nose, seizing him by it and pulling him down on his knees, where he remains, half in sorrow, half in anger, until he is allowed to rise and describe his symptoms.

Like many a surgical pioneer, Baron Dupuytren was not only baffled but frustrated by the problem of the projecting premaxilla. By 1829 his exasperation had risen to such an extent that he took hold of this "malpositioned knob" and twisted it off, utilizing the prolabium to construct the columella. He did acknowledge later:

M. Malgaigne . . . thinks that this is liable to objections. The most serious, according to him, is the removal of the germ of two, three or even the four incisors.

Sims

J. Marion Sims of New York, deservedly better known for his "position" on vesicovaginal fistula than on premaxilla, removed this structure in "a most horrible case of harelip," preserving the prolabium. Thirty-seven days after premaxillary excision, he trimmed the cleft edges and the prolabium with scissors and approximated the wound edges with a single through-and-through needle and with several interrupted sutures which were later reinforced by a type of tape support.

Rose

William Rose of King's College Hospital, London, wrote in 1891:

To my own mind the disadvantages of the retention of the incisive bone so clearly outweigh the prima-facie advantages, that in my practice I have
followed the usual course adopted by the majority of British surgeons in removing the bone at the earliest opportunity. By this removal the operation of the lip can be more successfully accomplished, and as regards the profile effect the later introduction of a dental plate with artificial incisors will greatly improve the appearance, and enable the patient to bite in a satisfactory manner, far more so, in fact, than with the mobile os incisivum.

Objection to removal

Yet, as early as the latter part of the eighteenth century, Chorin showed remarkable insight by objecting to the primary excision of the premaxilla. Obviously by observation he recognized that the ultimate result was a tight lip, dish face of the middle third of the face and relative mandibular prognathism. He wrote:

It will leave a considerable space between the maxillary bones; it will deprive the lip of its point of support at the place where it is divided; and if the reunion takes place, in spite of the disadvantages of such an arrangement, the action of the muscles will soon lessen the space between the maxillary bones, and the upper jaw will become contracted enough to fall within the under one, a circumstance which, at the same time that it renders mastication very difficult, will occasion a fresh deformity.

What Franco, Dupuytren, Sims and others did on purpose and out of desperation, some surgeons do inadvertently. The results are still loss of the premaxilla and a central deformity of the face.

POSTERIOR TRACTION BY VARIOUS TYPES OF EXTRAORAL APPARATUS

Following dissatisfaction with primary excision, ingenious methods of external compression were devised. It seems to have been a tug-of-war between the Germans and the French as to who could tug the hardest on the premaxilla.

In 1686 German Johan Philip Hofman presented a headcap with cheek extensions armed with corset hooks at the sides of the lip. When laced with tension, this apparatus could serve both to press on the premaxilla and to relieve the tension of the bilateral cleft closure.

By 1768 Louis, a French surgeon, blamed the clefts on lack of muscle retraction rather than loss of tissue and advocated "a
uniting bandage” with the aid of a bonnet. Chaussier, another French surgeon, in 1776 designed a cheek compression bandage for cleft lip to obtain a greater number of cures “despite the continuous movements of the little patients.”

**Desault**

In 1790 P. J. Desault devised a rather elaborate cloth compression bandage which he applied against the projecting premaxilla for 11 days preoperatively to exert steady backward pressure. This is a description of Desault’s bandage on a five-year-old bilateral cleft lip by his junior surgeon, Chorin:

In order to bring the protuberance to a level with the lip, and to depress the projecting portion of the maxillary bones, M. Desault, who as the principal surgeon of the Hôtel Dieu, Paris, undertook the treatment of the case, had recourse to a linen bandage, which passed over the upper lip and was fixed at the back part of the neck. The good effects of this bandage in compressing the parts in question were so obvious, that its use was continued until the operation was performed.

**Malgaigne and Hullihen**

Malgaigne used a similar type of cloth compression bandage in about 1844. Simon P. Hullihen, American dentist of Wheeling, West Virginia, was another to use external retraction in bilateral clefts, also in 1844. As noted by Robert Goldwyn in *Plastic and Reconstructive Surgery*, September 1973, Hullihen urged “preparatory treatment” in all cases, especially when the lip deformity was accompanied by a “cleft of the alveolar and palatine arches.” His initial treatment, like that of Thiersch, was an “adhesive strap” from one cheek to the other, but he advocated cinching it constantly:

The strap should be kept perfectly tense. It is therefore necessary to tighten it every day or two, which may be done by cutting a small portion out of the narrow part, and then sewing it together, without disturbing its adhesion to either cheek. . . . The time generally required to close a cleft of the alveolar arch, depends more upon the age of the infant than upon the size of the cleft. It generally requires from four to six weeks to close the cleft in infants under five months old. . . . As soon as the cleft edges of the alveolar arch are brought together so as to touch each other in the slightest manner, the operation for the cure of the harelip may be properly performed.
The Germans and others

Then the Germans began to tug again. In 1868 Von Bardeleben used a compression bandage with a bonnet as shown. In 1875 Karl Thiersch of Leipzig, better known for his thin split-skin grafts, used rubber bands stuck to the cheeks with an adhesive. This course of events not only reveals the participation of famous general surgeons in the treatment of clefts in the nineteenth century but points out the value of their sound logic turned toward cleft correction in the early days.

By 1892 Von Esmarch and Kowalzig were employing an elastic band attached to a headcap, which is beginning to get quite modern.

The Americans joined the ranks again, and in 1907 oral surgeon G. V. I. Brown used adhesive tape pressure across the premaxilla. Needless to say, the skin did not take this too well. By 1922 Federspiel was using the elastic band, and Cronin advocated it still in 1964.

Hans Derichsweiler, at the 34th Congress of the European Orthodontic Society in Copenhagen, claimed that the bilateral cleft “premaxilla could be fused with the prevomerine segment by extraoral traction alone.” This assertion stimulated Merton Griswold and Willis Sage of New Jersey in 1966 to develop an ultramodern bonnet of stout muslin on which a lip traction band made of a woman’s Playtex girdle (!) was hooked to exert 8 ounces of tension in babies and up to 14 ounces in older children. The apparatus was applied for six weeks to three months depending on the effect. To offset the maxillary collapse behind the premaxilla, they held the premaxilla in alignment while traction devices attached to the teeth were expanding the arch. With variations this general approach is probably the most popular preoperative treatment in use today.

CONTROLLED FIXED EXTERNAL TRACTION

In 1968 the Duke University Medical Center team of Georgiade, Mladick and Thorne suggested passing two Kirschner wires
horizontally through the cheeks, one through the premaxilla and the other through the posterior maxilla. The ends of the wires were bent into hooks, and rubber bands were applied to achieve controlled posterior traction. Subsequent experience revealed that wires tended to cut through the soft bone of the premaxilla.

Then in 1970 Nicholas Georgiade, part Greek, part Austrian, armed with dental and medical degrees, cunning and as capable in a casbah as on a college campus, devised a Dacron halter for his controllable traction. I watched him place one on a projecting premaxilla at Duke in 1971.

Five days before closure of the bilateral cleft lip, under local anesthesia, Georgiade passed one 0.054 Kirschner wire through the cheek just distal to the maxilla near its junction with the pterygoid plate of the sphenoid bone and distal to the tooth bud follicles. The wire was thrust across the cleft and through the opposite side of the maxilla until palpable under the cheek skin. A later improvement in his design was the fashioning of a premaxillary halter from a half-inch strip cut from Dacron arterial material. This Dacron strip was split into a lopsided Y with one prong extension several times the length of the other. The longer extension was passed under the prolabium to hug the premaxilla while the wider shorter extension was brought around in front of the premaxilla and fastened by sutures to the other end coming from under the prolabium. Thus the halter was complete, its two bands encompassing the “head and nose” of the premaxilla and leaving the two ends as restraining reins through which standard rubber bands were threaded. The rubber bands were then looped around Georgiade’s posterior transverse Kirschner wire exerting the required tension to cause retropositioning of the premaxilla.
Five days later the clefts of the lip were closed, and the intraoral traction was maintained another two weeks following the lip surgery. This contraption interfered with surgery and was not completely controllable so a better traction device was sought.

The value of a combined dental and surgical effort in the treatment of clefts is not new to Nicholas Georgiade, who nearly 30 years ago, having completed dental school and oral surgery training at Kings County, started medical school at Duke University. During the summer and holidays he joined the team of Dunning and McCaffrey in New York City. Henry Dunning, M.D., D.D.S., was a charter member of the Board of Plastic Surgery, and McCaffrey, D.D.S., was an ex-all-American football player from Fordham. Georgiade, who fitted into this team well as he was a medical student and had played a little football at Fordham, found himself involved in the surgical treatment of two to three lip and palate clefts a day.

Duke-Carolina game

So important are the premaxillary and other cleft problems that arch-antagonists have buried gridiron rivalries and joined oral and plastic forces against a common enemy, the projecting premaxilla. Georgiade of Duke and Latham of Carolina have developed what they refer to as the Mark III coaxial arch alignment appliance, with two concentric knobs protruding from the mouth, one for arch expansion and the other for premaxillary retraction. The expansion component is composed of a prosthesis fitted on each maxillary element and pinned in position with a cross wire attached to a gearbox so that a turn of the thumbscrews spreads the segments of the maxillary arch apart. The retraction component is a saddle attachment straddling the anterior vomer and fixed with a pin through the area posterior to the dentition of the premaxilla. This attachment is operated through a hollow tube by a screw device passing posterior to a gearbox (jackscrew) on the center of the cross wire of the prosthesis. One millimeter of posterior movement of the premaxilla is achieved by every turn of this second thumbscrew, and a turn in the morning and
Latham wrote me on June 15, 1973:

Dr. Georgiade and I are satisfied with the cable-screw premaxillary retractors and the gear controlled expansion appliance as used in a bilateral cleft infant at Duke University Medical Center last week. Dr. Georgiade managed to do the gingivoperiosteoplasty as well as the lip although vertical relationships were poor. The anterior ends of the maxillary segments will have to be controlled in the vertical plane as well as in the horizontal—i.e. the usual expansion-collapse problem. . . . I hope that it will soon be accepted that an effort should be made to close the alveolo-gingival cleft at the same time as lip closure.

I am not sure we have all the answers yet as to how to handle the premaxilla but certainly when I review my past 25 years of experience in dealing with these infants, who received the best treatment according to our standard, and who are now adults with collapsed maxillae, and flat upper lips, I cannot help but hope that we have learned something. . . . I certainly believe this rather simple appliance . . . must be a step in the right direction to prevent those horrible maxillary deformities. . . . Certainly this method of expanding the maxillary segments is a lot better than what the orthodontists have tried to force us to use with oral appliances that had to be turned in a screaming unhappy infant. The use of the cumbersome McNeil technique is not even in the same ball park as this simple apparatus.

Latham wrote me on June 15, 1973:

Dr. Georgiade and I are satisfied with the cable-screw premaxillary retractors and the gear controlled expansion appliance as used in a bilateral cleft infant at Duke University Medical Center last week. Dr. Georgiade managed to do the gingivoperiosteoplasty as well as the lip although vertical relationships were poor. The anterior ends of the maxillary segments will have to be controlled in the vertical plane as well as in the horizontal—i.e. the usual expansion-collapse problem. . . . I hope that it will soon be accepted that an effort should be made to close the alveolo-gingival cleft at the same time as lip closure.
By late October 1973 Latham reported:

We have now used this appliance three times with considerable success. In all three, to my great satisfaction, an attempt was made to put downward traction on the maxillary segments. This worked well on the first and not so well on the other two—but I'm dealing with some of the difficulties and I'm sure this is going to be a big part of the treatment.

Latham’s reasoning:

As the brain grows the cranial vault sutures are put under tension and osteogenesis occurs as required. You have two sutural surfaces separating and new growth occurring to keep the bone edges the same distance apart—say 0.2 mm. . . In my work toward a Ph.D. in Liverpool in 1966 I found that in the rapidly growing facial skeleton of the fetus osteogenesis was not a feature of the sutures around the maxilla. It was obvious that at that time skull growth was most rapid. Then I came to what I regard as my most important observation: the bones were sliding past one another at the sutures, they were aligned in the direction of bone movement and bone formation was not necessary for this movement. The factor that would control such sliding would be the adjustment of the collagen fibres holding the bones together at the joint. It seems that such adjustment of the collagen fibres interlacing across the suture could allow much more rapid movement of the bones than if such movement were dependent upon the rate of bone deposition at a separating suture. Think of the continuously erupting incisor tooth of the rodent. The tooth is moving or sliding out of the socket all the time, while collagen peridontal ligament adjusts in the intermediate plexus where the fibres from the bone and tooth divide into a fine intermeshing network. Put the palms of your hands together with elbows outward. Now slide one hand over the other with elbows moving out. The hands may move in opposite directions for a great distance before contact at the inter-palmar surface is lost. Now to maintain that contact growth needs only occur at the finger tips. Such is the economy of bone formation in the rapidly growing skull.

Here is a coronal section of the zygomatic-maxillary suture from a three-week-postnatal infant offered by Latham to demonstrate the five layers which he says are indicative of the suture adjustment mechanism.

He noted:

The suture uniting the two bones shows five tissue layers: The periosteal, osteogenic and fibrous capsular layers of each bone respectively with a
middle loose vascular layer. The collagen fibers of the capsular layers are oriented mainly parallel to the bone margins and this facilitates the movement of one bone in relation to the other since adjustments occur mainly in the middle zone and at the periphery of the suture where uniting layers of fibers pass directly from one bone territory to the other.

Latham adds:

This means that sliding is a normal mechanism between two bone surfaces and this is what is being required of the vomero-premaxillary suture as retraction force is placed on the premaxillae. So we have to exploit this mechanism, work within its limitations. And that’s mainly why I didn’t like Dr. Georgiade’s rubber bands. The screw mechanism allows us to do this job in a series of steps; at each step we would push the collagen as far as it would adjust and stretch within the bounds of normal physiology.

Maybe you will begin to see why I am keen to put the maxillary segments exactly where we want them, because I’m confident that they will move—when given some reason to move!

Latham and Workman in the 1974 Symposium on Management of Cleft Lip and Palate and Associated Deformities further justified the Mark III positioning of the premaxilla by rapid compression:

The columella cartilages are covered and obscured by the alveolar process of the premaxillary segment. The position of the medial crura is probably correct and should be preserved. The close relationship between the medial crura and the bony alveolar process is one of gradual acquired approximation. They are not firmly united one to the other and may be readily separated by posterior traction. The premaxillary segment may be moved to
a more normal position, at the same time uncovering the columella cartilages. . . . It is to be hoped that this rationale will tend toward the manifestation of normal relationships and appearances in the lip and columellar region with later growth.

Finally in July 1975, Georgiade and Latham again promoted their pinned coaxial screw appliance.

Because the protruded premaxillary segment may be retracted rapidly in 7 to 10 days, and this may be scheduled at the same time as lip surgery, orthopedic management of this formidable malformation is now practical and, therefore, available to all such infants as a routine procedure.

SIMPLE EARLY CLOSURE OF LIP CLEFTS TO SERVE AS MOLDING ACTION

The reconstitution of the normal restraining muscle band gives satisfaction in a good percentage of cases. In fact, when the premaxilla, in addition to the projection, is rotated to one side, the closure can be staged to advantage. By closing the lip cleft across the widest gap, one can pull the premaxilla into a straight position in preparation for lip closure on the second side. DeHaan admitted, in Stark’s 1968 *Cleft Palate*, that surgeons disagree on whether the premaxilla should be recessed primarily but concluded:

We have not found the prominent premaxilla a serious problem; once the lip is closed it usually exerts sufficient pressure for the desired retrodisplacement. We feel that operative recession of the premaxilla may well interfere with growth of the central third of the face.

Bauer, Trusler and Tondra in Indiana in 1959 and Glover and Newcomb in Ohio in 1961, all as a result of long-term reviews, decided against surgical setback of the premaxilla as their best results were with simple soft tissue closure.

As early as 1954, there appeared an interesting report. Slaughter of Loyola University and the University of Wisconsin, and Pruzansky of the University of Illinois College of Dentistry realized the importance of muscle closure across the cleft.
Accompanying the cleft lip repair is the simultaneous reestablishment of the prime function of the orbicularis oris muscle—that of a sphincter-like action, plus the accompanying changes of the accessory muscles of the immediate vicinity. This is the prime motivating force responsible for favorable reconfiguration of the bony skeleton of the middle one-third of the face.

Slaughter and Pruzansky's main theme was that the surgery should not be allowed to have an adverse effect on the future growth patterns. They acknowledged:

Since the cosmetic results immediately following repair of the bilateral lip cleft may be less than desired, it is significant to note that serial studies have indicated that the differential processes of facial growth tend to minimize the deformity and provide a more desired end result. In some children such spontaneous correction of the premaxillary protrusion may occur rather early and in others at a later age. Of course, there are rare exceptions in which there is no such improvement in facial profile. In such instances section of a portion of the nasal septum may be required but only as a last resort . . . and based on documented serial observation (cephalometric roentgenograph) over a period of at least five to six years.

In 1972, from the Center for Craniofacial Anomalies at the University of Illinois Medical Center, Hans Friede, D.D.S., and Samuel Pruzansky, D.D.S., summed it up with cephalometric radiographs and dental models in a longitudinal study of 54 complete bilateral cleft lip and palate cases. Their conclusions were:

1. The common denominator that characterizes this cleft is the marked protrusion of the premaxilla, resulting from an overgrowth at the premaxillary-vomerine junction.
2. Considerable in-group variation existed, in the extent to which the premaxilla protruded ahead of the palatal shelves.
3. The degree of premaxillary protrusion first observed in the unoperated infant is a useful prognostic indicator of later changes in his profile.
4. In cases operated by closure of the lip without premaxillary setback, the facial profile approximated the averages for the non-cleft population by the time the children reached early adolescence.
5. The amount and direction of mandibular growth is a significant factor in the ultimate improvement of the facial profile.

Twelve years after their switch from surgical setback Bauer, Trusler and Tondra reported candidly in 1971:

Surgical retropositioning of the premaxilla in our hands has consistently resulted in severe growth disturbance of the middle third of the face. Since excellent results with surgical retropositioning of the premaxilla in selected cases have been reported by Cronin and Monroe, it may be assumed that our technique was in error. If the lip is repaired in two stages, it is our belief that surgical retroposition is unnecessary. The motor force of the repaired lip will eventually bring the premaxilla into proper relationship with the mandible. Recent articles on this subject by Berkeley, Glover and Skoog have been in agreement with this approach.

It is interesting that the Indiana group closed the first side at two weeks of age and the second side two months later.

Skoog of Sweden in the same 1971 tome summarized:

Surgical correction of bilateral clefts is accomplished by operating upon one side at a time, the first operation being done at the age of 3 months. . . . In asymmetrical deformities the most severe cleft is repaired first. Three months later the other side is operated upon.

**EXCISION OF THE PREMAXILLA SECONDARILY**

Professor Kilner of Oxford closed the lip of his bilateral clefts in two stages, trusting the pull of the united muscle to reduce the prominence of the premaxilla. Actually this muscle pull was responsible for the swinging in of the maxillary processes which trapped the premaxilla in front of the alveolar arch and necessitated its removal in about 90 percent of cases. He did not approve of a wedge osteotomy of the septum, explaining that it was dangerous to the growth of the premaxilla, which he preferred to maintain as a lip rack during facial development. At the age of five to seven years, however, if it was wobbly and useless, he removed it and substituted a denture.
A PARTIAL PREMAXILLARY EXCISION

In 1957 a compromise was suggested by Gillies, who was familiar with the premaxilla, which often fails to gain union and becomes a wobbly prow with abnormal teeth deserving discard. He posed the possibility that

the anterior mucous membrane be peeled back from the premaxilla and the anterior bone and tooth-buds be rongeured away. This leaves a posterior strip of bone sandwiched between two layers of mucosa. If this bone strip is now moved back and introduced snugly into the cleft, the edges of which have been freshened to bone, there is the better chance of bony union across the gap and preservation of the full arch.

In 1968 in the *British Journal of Plastic Surgery* John Potter explained his change to a more radical handling of the premaxilla somewhat like that of Gillies. In 1959 he had been faced with twins each having bilateral clefts of the lip and palate. In the girl he had used the standard closure over the projecting premaxilla, retaining the prolabium in the lip. The boy twin, who had developed a tumor of the premaxilla in the first few weeks of life, underwent excision of the tumor. A pathological report by Professor R. Willis is of interest:

This is a typical specimen of the pigmented epulis of infancy. The upper incisor region is its commonest site; but your specimen is of special interest in that it came from this site in a case of cleft palate. In spite of its extent and infiltration, it is essentially a benign lesion, which is readily cured by local excision and which has not metastasized in any of the reported cases.

Subsequent surgery involved a two-stage union of the lip to prolabium. The result of this forced reduction of the anterior premaxilla impressed Potter with its better nasal tip, columella and lip. In fact the twins' mother remarked that she wished the girl had had this type of repair instead of the boy! After three years' observation, Potter decided:

It was worth making further efforts in an attempt to obtain a better nasal tip at the original repair.

In fact, 14 years later he was still pleased with the nasal tip.

In 1968 he presented a report on the twins and a third case
which was handled in a manner greatly influenced by his experience with the twins. He started out:

The problem is that before the repair there exists a flattened nasal tip with a short columella and wide nostrils, because the pre-maxilla bulges into the nostrils.

He then explained that no matter what the surgery this condition "leads to obstruction of the airway and a chronic catarrh." His surgery involved elevating the premaxillary mucosa, and he continued:

The anterior plate of the premaxilla was exposed and removed in the upper two-thirds, the tooth sacs were removed, the central septum was leveled back, in order to get it into what was thought to be its normal relationship with the nasal spine. . . . The soft tissues were allowed to settle for eight weeks and then the floor of the nose and the lip were repaired in one stage. . . . The procedure gave a good nasal tip, a good airway, and no chronic nasal discharge. The lip is good but may need an Abbe flap.

Potter mentioned loss of the upper incisor teeth, and three years later the profile was already showing definite retroposition of the premaxillary area. He did use a small Abbe flap eventually. In 1974 Potter wrote:

I have a new case to begin and I hope to save the teeth.

A secondary rendition of this rather radical approach was presented in 1973 at Duke University by Frank Masters of Kansas City and published with D. B. Apfelberg in 1974. When the premaxilla is otherwise useless because of malposition, mucoperiosteal flaps of the premaxilla and maxillae are opened on each side of the clefts and sutured together to form one long trough into which bone from the premaxilla is packed as cancellous
chips. Then the flaps are closed to form a reduced alveolar ridge on which a dental plate can be fitted.

PROSTHODONTIC ASSISTANCE

It was the experience of lip closure followed by maxillary arch collapse that led to the 1954 work of C. Kerr McNeil, who advocated delicate but continuous forces to influence the direction of the growing bone. Burston soon joined these forces. They proposed as an ideal approach

the prosthodontic techniques of early stimulation of the maxillae by a changing prosthesis until they are in alignment with the protruding premaxilla and thus alleviate the necessity to section the vomer.

The elaborate setup that Burston has in his anatomy department in Liverpool cannot be duplicated many places in the world. Thus, Hagerty and Mylin improvised pinning in a screw plate which, if fitted in the early days of life, can be maintained with relative ease and can have a great influence in positioning the maxillary elements. The jutting premaxilla still poses a problem.

Spring plate and rubber band

In 1967 William M. Manchester of Middlemore Hospital in Auckland, New Zealand, in his typical direct manner crowned the bilateral cleft the most difficult modern surgical problem, not excluding cardiac surgery, and blamed the premaxillary protrusion on lack of muscle restraint and abnormal tongue pressure. To combat this deformity he enlisted the services of orthodontist J. H. Pear, who developed an upper dental plate divided in two halves joined by a spring. The plate has two segments which overlap each other so that when the apparatus spreads, under its own slight spring tension, there is still an effective roof to the mouth. This plate is used in conjunction with rubber band traction and prevents the tongue from counteraction. After five months in a case with a protruding premaxilla, "the alveolar arch forms a continuous horseshoe and the premaxilla is acting as a stable keystone between the maxillary segments."
LIP ADHESION

In a frantic attempt to obtain some kind of closure over the projecting premaxilla in bilateral clefts, Simon in 1864 cut two lateral cheek flaps, transposed and sutured them to the sides of the prolabium in what was probably one of the first adhesion procedures ever done. Once the pull of the flaps had partially repositioned the premaxilla, Simon proceeded with his second-stage definitive lip closure.

The next examples of adhesions were more sophisticated. In 1955 Johanson of Göteborg used a type of adhesion to create a tissue bridge for the insertion of bone grafts. By 1958 I was using early lateral vermilion attached to the inferior prolabium for blood supply to that component, but in the process, of course, some premxillary molding occurred. By 1961 Johanson had become suspicious of primary bone grafting but intrigued by the beneficial effect of the early adhesion. In 1963, encouraged by the effect of the early adhesion in bilateral clefts, I used a high mucosal adhesion in a severe cleft specifically as a stalling tactic and a molding device. My report was published with other refinements in 1964.

In 1965 Randall advocated a modification of this adhesion with more sacrifice of lip skin expendable only in his type of cleft lip closure. Takahashi of Tokyo in 1970 diagramed both the "Millard" and the Randall adhesions and published some interesting bilateral cases in which he had used lip adhesion procedures in two stages prior to a forked flap columella lengthening.

In 1971 Hamilton, Graham and Randall reported the "lip adhesion" in 14 complete bilateral clefts and on the complete cleft side in four cases with the incomplete cleft on the opposite side. In the complete clefts one side was joined at a time and at the average of 3.5 months of age, the opposite side being joined about 1.2 months later. The adhesions were maintained for approximately six months, and then a definitive lip closure was performed.

A few extracts from Randall and Graham summarize their use of the adhesion procedure:

Broad-based rectangular flaps [were] constructed from tissue that is ordinarily discarded. . . . Extraoral traction on protruding premaxillae has not
been necessary. Osteotomy to reposition a protruding premaxilla has seldom been needed. Any lateral soft tissue undermining has been rare and minimal. . . . For two years the lip adhesion operation has been carried out on all complete unilateral and bilateral clefts at the Children’s Hospital of Philadelphia. . . . When considerable separation of the lip margins is present, particularly when associated with bony distortion . . . the operation seems to have merit.

Finally, in 1973 Randall incorporated early columella lengthening with a primary forked flap during one side of an adhesion procedure at three months and three months later created an adhesion on the other side of the lip.

Highest

A variety of adhesions have been advocated over the past 20 years. In 1962 Celesnik of Ljubljana proposed simple closure high up in the nasal floor on each side as a first stage. This approach was presented in Copenhagen in 1973 by his previous student M. Perko of Zurich. After orthodontist Margaret Hotz creates alignment of parts, Perko makes a Celesnik I nasal floor adhesion at six months and one month later carries out a bilateral Veau or Manchester definitive lip closure. Here is one of their cases followed through an impressive orthodontic and adhesion staged premaxillary alignment, later published in the 1975 Scandinavian Journal of Plastic and Reconstructive Surgery.
Since 1967 K. Hollmann of Austria, in a desire to avoid the chances of maxillary growth retardation by mucoperiosteal dissection, has been carrying out a one-stage inferior lip adhesion almost identical to the one I used for several cases beginning in 1958. Hollmann attaches mucosal flaps from the cleft edges of the lateral lip elements to the inferior prolabilium vermilion. His variation is a tucking of the tips of the lateral flaps under the central prolabilium rather than overlapping it. He postpones his definitive lip closure until two years of age.

Personally, since my earliest cases I have not been particularly interested in using the adhesion procedure for traction in bilateral clefts. Usually there is not the problem of asymmetry—in which I find an adhesion most beneficially equalizing. The definitive lip surgery is relatively easy as soon as the rubber band traction has adjusted the premaxilla. I prefer to skip the adhesion and close both clefts in one operation. In those rare cases in which the rubber band is ineffectual, I would favor a bilateral mucosal flap adhesion to a surgical setback.

**Two-stage adhesion without undermining**

In 1966 Walker, Collito, Mancusi-Ungaro and Meijer of East Orange, New Jersey, advocated the ultraconservative combination of elastic extraoral traction followed by lip closure without undermining:

In effect, the elastic band substitutes for an intact lip and creates the antagonistic forces of a normal orbicularis oris muscle. In the absence of lip surgery and intraoral appliances, elastic traction decreases the severity of the lip and palate defects. . . . Thus, the bony foundation is established for lip closure with minimal or no undermining of the soft tissue.

They feel that undermining the lip elements from their attachments to the maxilla changes the muscle environment and that the scarring produced is deleterious to the growth of young bone. A far greater number of surgeons seem to be concerned for the freeing of the abnormal attachments of the muscles so that the tension of lip closure will be reduced.

In 1971 Dutchman Robby Meijer of the Peer Group and dentist Michael Collito of East Orange, New Jersey, reported on
 According to Meijer and Collito:

Of special significance, however, is that in our group all cases continued developing into a favorable arch form while 60 percent of the Pruzansky cases deteriorated.

Here is a case sent by Meijer in 1974 which had a preliminary lip closure on the right 3-19-65 and on the left 6-23-65. A definitive lip closure was done on the right 11-5-65 and on the left 12-21-65. The soft palate was closed 6-1-66.

SHORTENING THE SEPTOVOMERINE STALK

Compression fracture

In 1833 Gensoul in Paris is reported to have seized the projecting premaxilla with a strong forceps and forced it back with sufficient
strength to fracture the vomer.

In 1844 Pancoast of Philadelphia illustrated his method of positioning the premaxilla. He explained his sketch in the following manner:

This represents the forcing backwards with a pair of flat-bladed forceps of the prominent portion of the jaw, in which the two incisor teeth are lodged. This attempt to bring the teeth down to their proper level is commonly attended with slight fracture of the bone.

In 1961 Cyril O. Innis, off in North Borneo and faced with two projecting premaxillae in nine-year-old Chinese children, revived the idea of compression fracture of the vomer. He then wedged the mobile unit back between the lateral alveolar segments and closed the lip on both sides using no further fixation. He concluded:

This method has, I feel, the advantage of simplicity [agreed]. There is minimal disturbance with growth centres of the premaxilla [...]. The disadvantage probably lies in that by this method, obstruction of the nasal airway might result and it is difficult to correct excessive downward displacement in relation to the rest of the alveolar arch of the premaxilla.

According to Fomon, about 1873 Drachter was nicking the neck of the premaxilla, forcing the bone into contact with the alveolus and repairing the corresponding side of the lip. At the second stage he repeated the process on the opposite side. This maneuver not only tilted the fragment backward, causing the teeth to erupt lingually, but displaced the septum backward, flattening the alae and retracting the columella.

*Full-thickness resection of vomer*

In 1842 Blandin retroposed the protruding premaxilla by resect-
ing a triangular piece of vomer bone and mucosa in a rather unsophisticated setback.

Subperiosteal section of vomer

Adolf Von Bardeleben of Germany was the first to section the vomer subperiosteally, in 1865. Through a 1 cm. incision along the free border of the vomer behind the premaxilla the mucoperiosteum was elevated on both sides so that scissor section of the septum as high up as possible allowed the sectioned septal ends to glide past each other without buckling as the premaxilla was repositioned. There have been many modifications of this design but Von Bardeleben’s approach remains the basis of the operations in use today.

Another backward overlap

John F. Binnie of Kansas City, Missouri, in his 1916 edition (the seventh) of *Operative Surgery* noted:

Some surgeons advise that the misplaced intermaxillary bone be entirely removed. . . . Undoubtedly it is wise to retain the bone and replace it in its proper position. . . . Sometimes instead of excising a wedge from the septum it is sufficient to make a vertical cut through it and slide that portion of the septum anterior to the cut back alongside the posterior portion.

Binnie used a drawing from Von Esmarch and Kowalzig to demonstrate this method of overlapping the septum.

Pichler

In 1918 H. Pichler of Austria dissected the mucoperiosteum from the vomer, divided the denuded vomer 2 cm. behind the premaxilla and, during the premaxillary setback, slid the septal fragments side by side. Instead of closing the mucoperiosteum over the sectioned and overlapping septum, Pichler ingeniously
turned these flaps laterally and tucked them under the palatal mucoperiosteum which he had elevated from the hard palate.

Federspiel

Matthew N. Federspiel, Professor of Oral Surgery and Orthodontics at Marquette University in Milwaukee in 1927, described a variation of premaxillary "set-back." He freshened the edges of the alveolar cleft, then through a longitudinal incision in the mucoperiosteum over the vomer achieved an oblique sectioning of the vomer so that with a slide back there was overlapping but reduction in premaxillary protrusion.

Vaughan

Vaughan described a similar method of premaxillary positioning in 1946. Through a submucosal dissection, beginning 1.5 cm. posterior to the premaxilla, an oblique section of the vomer was achieved with a chisel. This cut was extended upward into the cartilaginous septum in an area where the premaxillary blood supply was in no danger. The premaxilla was then slid posteriorly and overlapped without rotation on its transverse axis and without blocking the nasal passages. The vomer overlap was fixed with a silver suture and the mucosa closed.

Schultz

In 1946 Louis Schultz of Chicago set back the premaxilla and mentioned the numerous problems faced, such as time involved, lip scarring from tension, lack of bony union, fistulae and poor bite if setback was not done.

All these undesirable factors are avoided if the intermaxillary bone is brought to its normal position when the child is about one month old.

He suggested two ways to mobilize the premaxilla, one by V resection of the vomer and the other by diagonal sectioning and
sliding of one vomer segment over the other in a manner described originally by Federspiel and by Vaughan only two months before his own presentation.

_subperiosteal resection of the vomer_

In 1868 Guerin retroposed the premaxilla by subperiosteal resection of a triangle of vomer bone combining the principles of Blandin and Von Bardeleben.

In 1911 Reich supplemented the vertical wedge resection of the vomer (A) with horizontal septal cartilage division (B) to reduce the premaxillary prominence but at the same time prevent septal and nasal tip collapse and avoid what he referred to as "a blunt and bull dog nose." This general approach is similar to what Cronin advocated later.

_Veau_

In 1922 Veau described resection of the neck of the premaxilla as a prelude to displacement of the bone, "as one would close a drawer." To promote union at the alveolus, the bone ends were freshened and sutures were used for stabilization.

Yet in 1938 Veau reviewed 208 cases of bilateral clefts which he had treated surgically in different ways and decided against operation on the premaxillary prominence.

Veau's final feelings are expressed more poignantly in French, I guess:

Le malheur de cette chirurgie est que nous ne pouvons tirer un enseignement de notre operation que plusieurs années après l'avoir pratiquée.

_St. Louis soundness_

Most surgeons today still agree with the wise words of Brown, McDowell and Byars of 1947:
Briefly, the problem of the premaxilla is that it is nearly always too far forward in the newborn baby, but only with considerable effort can it be kept from being retruded too far backward in the adult.

They set forth a sound plan:

As a rule, the premaxilla is not disturbed or set back if the lip can be closed with it in its original position unless: (a) it is badly tilted or rotated or (b) it is so far forward that the elastic pressure of the closed lip might bend the septum and occlude one or both nasal airways. If the premaxilla is to be set back, it is set back the least possible amount necessary to allow successful closure of the lip. This is done by splitting the mucosa over the bottom of the vomer and resecting a block of the vomer just back of the premaxilla. The premaxilla is set back until it is in contact with the vomer again and immobilized by a wire suture through both fragments, or better by nailing a straight Keith needle directly backward through the center of the vomer. . . . Bony union between the premaxilla and vomer is rarely obtained but the fibrous union helps a good deal in keeping it centered.

Twenty years later McDowell, having reviewed the cases over those years, stated that the situation with the premaxilla continued as predicted. He recalled their advice to set back the premaxilla surgically the minimum amount to make immediate successful closure of the lip possible and concluded:

Various surgeons expressed fears that this would be followed by various types of disaster, but these have not occurred when the work was carefully executed.

Huffman

In 1949 Huffman and Lierle at the State University of Iowa repositioned projecting premaxillae by quadrilateral resection of vomer. At the same operation they attached the already elevated vomerine flaps to the medial incised palatal flaps in a first-stage palate closure, a feat not always possible, which leaves the sectioned vomer in the open.
Other forms of quadrilateral resection followed. Thomas D. Cronin of Baylor University College of Medicine, Houston, thoughtful and always searching for a better way, was a promoter of the vomer resection. In 1957 Cronin reported that, out of five early cases of triangular wedge resections of vomer, in one the premaxilla was loose and displaced posteriorly, in another there was tooth removal and two showed surgical displacement and slight movability. These findings led Cronin to his rectangular sliding pushback of the premaxilla, similar in principle to Reich's approach. He described the method as follows:

A 2 cm. incision is made over the inferior free border of the vomer about 1 cm. posterior to the premaxilla. The mucosa is elevated from each side of the vomer. . . . The amount of protrusion is measured and 3–4 mm. less than this amount of vomer is removed as a rectangle, using a sharp osteotome to get clean cut surfaces. . . . With a right angle palate knife a horizontal cut is made in the septal cartilage toward the bridge of the nose, so the premaxilla can be slid straight back without tilting of the teeth. . . . The prolabium is lifted up with a hook and a .035 Kirschner wire is drilled through the premaxilla and vomer out through the cut surface. The two vomerian fragments are lined up carefully and the wire is driven into the posterior portion with a mallet. . . . The resected piece of vomer is cut into small chips and packed around the junction to help insure bony union. Six to eight weeks later the wire is removed and the lip is repaired over the solid premaxilla.

In 1964 Cronin called attention to two important anatomical aspects pertinent to projecting premaxillae that had been noted by Scott. The lower edge of the septum lies in the vomerine groove where it is separated from the bone by a mass of fatty fibrous tissue. On the inferior margin of the vomer there is a bulge about 1.0 to 1.5 cm. posterior to the premaxilla. This is the site of a suture between the vomer and the prevomerine bone and is, doubtless, where forward growth of the premaxilla occurs. Cronin points out that surgical procedures should avoid damage, not only to this suture, but to the all-important growing septal cartilage. He advised the setback only for marked protrusion that seriously compromises repair of the lip. He also noted that a modification suggested by Burston and Kernahan of Liverpool in 1961 might possibly be less likely to cause any disturbance in
growth of the septal cartilage. Instead of making the Cronin horizontal incision in the cartilage, they advocated freeing the septum from the groove in the prevomerine bone with a septal elevator and sliding the premaxilla backward after making an oblique cut through the prevomerine bone. The premaxilla is then skewered onto the vomer with a Kirschner wire.

In 1960 Kahn and Winsten, from New York Mount Sinai Hospital, advocated the Cronin type of premaxillary retropositioning, stating:

If properly performed, no growth retardation of the nose, nor instability of the central section of the lip will occur. We set back about 50% of the cases.

Yet they cited only a three-year follow-up of the cases.

In 1971, for *Cleft Lip and Palate*, Ray Brauer gave the latest Texan reflections for the Cronin surgical setback.

Cronin and Brauer have relied on this procedure in the past, and though some degree of retrusion has appeared in these patients, it has been no more than that seen in patients in whom no operative setback was done. In those patients in whom retrusion and collapse have appeared, response to orthodontia has been excellent. . . . The mucosa is carefully elevated off the septum, and a rectangular segment of bone is removed . . . usually 5 mm. less than would be required for a complete setback. A right-angle knife is used to make a horizontal cut through the septal cartilage from the side of the resection toward the tip of the nose, to allow the premaxilla to move straight back. It is then fixed by a longitudinally placed 0.035 inch Kirschner wire.

*Monroe*

In 1965 Clarence Monroe published a report on “Recession of the Premaxilla in Bilateral Cleft Lip and Palate.” He has remained a staunch but conservative defender of this action ever since and at many a meeting has been called to the rostrum to justify or explain his stand. He has since been joined at Chicago’s Children’s Memorial Hospital by suave orthodontist Sheldon Rosenstein, and in the spring of 1973 at the Foundation Symposium at Duke University they presented their combined approach. Rosenstein advocated “doing something early to improve the late results” and expressed conviction that a prosthesis, arch molding
and bone grafting with maintenance of the prosthesis until palate closure at 15 to 18 months produce "occlusion and arch form better than before." Monroe repeated his belief that, when necessary at three weeks to three months, primary recession is not harmful if done correctly. He proposed the rectangular resection of septum posterior to the enlargement suture combined with horizontal incision in the septal cartilage to allow premaxillary pushback and fixation with a Kirschner wire. The setback should undercorrect, and as an example he mentioned a case of 18 mm. protrusion which received a recession of 13 mm., or 5 mm. short of complete inset into the maxillary arch. Monroe reported in his quiet unpretentious manner that 15 out of 19 cases of early surgical setback showed good occlusion but admitted that in spite of this 75 percent with good results he rarely does one today. Since 1964 he has set back only three premaxillae: (1) a severe projection in a mentally retarded patient; (2) a 15 mm. projection which use of a prosthesis and cleft closure failed to affect, so a 6 mm. setback was executed; (3) one with so much protrusion that recession was required for lip closure.

Monroe, who as early as 1959 proposed recession of the premaxilla, in the October 1974 follow-up clinic summarized:

Even though we do not have evidence that our operative procedure appreciably alters the growth pattern in these children, we are no longer doing the operation in the newborn. Our orthodontists have been able to guide the position of the premaxilla better with a prosthesis in the mouth than we were able to do it by surgical means. . . . After closure, the muscular lip will usually restrain the premaxilla and the prosthesis in the cleft will usually maintain the width of the maxillary arch until the premaxilla comes back into it. If the premaxilla does not come back properly by the time of palate repair (one to two years)—and it occasionally does not—we then recess the premaxilla before repairing the palate.

N. John Wilde of Valley Children’s Hospital, Fresno, California, in 1960 expressed preference for removing a quadrilateral section of vomer but advocated fixation of the premaxilla using bilateral transpalatal cross-needles. He noted that

the position of the premaxilla in relationship to the vomer and to the lateral palatal processes, is readily maintained. . . . The use of two needles prevents
rotary displacement [and] does not permit the premaxilla to slip. . . . The only disadvantage is the possibility of damage to tooth buds in the premaxilla.

*Prevomerine bone excision*

A more anterior quadrilateral resection was used in London. Sir Denis Browne, a pediatric surgeon, was orthopedic in his thinking. His reasons and design for setting back the premaxilla are interesting. As he wrote in 1949:

For some mysterious reason, when there is a cleft of the gum, new bone begins to form in front of the vomer, between it and the premaxilla, so drawing the latter forward. The vomer itself does not grow, and the division between it and what may be called the prevomerine bone is marked by a cartilage-filled suture line.

He felt that if the premaxilla were not moved into normal position and fixed firmly there would be great difficulty closing the lip over it, a very ugly profile like that of an animal snout would occur and it would be extremely hard later to fit a denture over a wobbly gum. He refused to accept the claim of others that closure of the muscle in front would position the premaxilla. He admitted:

Replacing the premaxilla has got a bad name because of the erroneous way in which it has been carried out. For instance, if a wedge is taken from the vomer, as usually advised, the foundations of the nose are ruined and it goes flat on the face.

To get a good result, he explained:

1. Cut the soft tissues of the lip away from the premaxilla right back to the nasal septum.
2. Make a longitudinal cut over the prevomerine bone and remove it submucously with narrow biting forceps. This should allow the premaxilla to be forced straight backwards into the normal line of the gums. It is preferable to leave it a little too far forward rather than to force it too far back.
3. With an awl carry a stitch of very strong suture through the alveolar ridge on either side of the gap. Bring this through the holes in the spiked bar, force this bar into the narrow upper part of the raw surface of the premaxilla and tie it so that this is fixed firmly in position.
4. Cut the mucosa off the posterior and lateral sides of the premaxilla. This is to give a raw surface to receive mucoperiosteal flaps cut from the
anterior ends of the hard palate. These flaps are sutured with linen.

5. Leave the plate in position for a fortnight.

One disadvantage of the method, he admitted, was possible damage to the tooth germs by the sutures through the alveolar ridge.

The dynamic and articulate David Matthews, also of the Hospital for Sick Children, London, and in a position to make an unemotional evaluation of Browne’s approach, stated in 1952:

Denis Browne now has a very large number of children who have grown up without any secondary distortions appearing and the excellence of his results has convinced me that premaxillary reposition is a satisfactory procedure and is indicated in the more severe cases of protrusion.

Matthews’ setback was similar to Browne’s except that he used a bayonet-shaped pin rather than the bar and carried out the nasal floor and anterior palate closure of Veau on one side at the same time. Three weeks later the opposite side was closed similarly. His 1973 comments are of interest:

In answer to your question about Denis Browne’s push-back of the premaxilla in bilateral clefts, I have seen a good many of his cases and of mine and there is no doubt at all that if the swelling on the septum a centimeter behind the premaxilla, which Denis Browne described as the prevomerine suture line, is encroached upon, there is retardation of subsequent development of the premaxilla. I have not, however, seen this happen if this prevomerine suture line is undamaged. If one restricts the operation to the very severe cases of protrusion, septal resection in front of the prevomerine suture does bring the premaxilla back far enough to produce a good arch alignment with the lateral segments. It is, therefore, my invariable rule to put a primary rib graft between the premaxilla and the lateral segment on both sides in the case in which I set the premaxilla back. With the stabilization of the premaxilla obtained in this way, not only does the premaxilla seem to grow satisfactorily but the “dog-mouth” deformity is avoided and the arch remains reasonably good. On occasion, as you know, the tooth buds migrate along the line of the bone graft.

**Prevomerine bone graft**

In 1960 in Munich, Oberniedermayr advocated surgical retro-positioning of the premaxilla, stabilization with Kirschner wire transfixation and the use of the resected prevomerine bone for grafting. Although this was an economical maneuver, evidently it
was in vain as most of this bone was reputed to be lost from infection.

Then in 1962 Gerhard Pfeifer of Hamburg, while working under Professor Schuchardt, developed a method of triple osteosynthesis for exceptional cases of bilateral cleft with extreme protrusion of the premaxilla. Mucosa was turned to form a bed for the transplants. A cylindrical piece of prevomerine bone was taken, split into two pieces and inserted into both alveolar clefts to fix the alignment of the retroposed mobile premaxilla.

Pfeifer claimed a stable union with symmetry. Yet to get enough bone for effective grafting there might be overcorrection of the premaxilla. Including the septovomerine suture in the bone graft certainly increases the chances of retardation of central facial growth. When enough prevomerine bone, however, is available to supply sufficient graft and still undercorrect the premaxillary projection, this operation has some appeal.

Absence of cleft palate makes a difference

There is a projecting premaxilla that offers an unusual problem. As noted by Antia of Bombay in the British Journal of Plastic Surgery in 1966:

Clefts of the lip associated with cleft alveolus but not of the hard or soft palate represent a common type of cleft in India. The premaxilla in this case may vary from a small, grossly inadequate element to an excessively large bony prominence. The general development of the alveolar arch is not affected by paring of the excessive premaxillary element due to the normal fusion of the hard palate behind the incisive foramen. It is recommended that bony excision of redundant premaxilla be undertaken.

I agree with the recommendation as I did exactly this excision
in November 1958, and alveolar alignment and tooth development are excellent today, as shown in Chapter 18.

To push or not to push

Despite the many frantic, conservative and ingenious methods of dealing with a projecting premaxilla, it is still *well out in front* as the most controversial and difficult problem in lip and palate work.

Early and late disapproval of setback

In 1916 Binnie noted:

Lane thoroughly disapproves of all these attempts to replace the intermaxillary bone.

This comment is interesting as Sir Arbuthnot Lane’s treatment of cleft palate by turning large mucoperiosteal flaps and leaving huge raw areas was by no means conservative otherwise.

After 15 years’ experience with bilateral cleft lips using the methods of Vaughan and Brown for premaxillary setback, Bauer, Trusler and Tondra decided:

There should be no surgical retropositioning of the premaxilla because of interference with growth and development of the face.

LeMesurier used his orthopedic logic in his 1962 *HARE-LIPS and Their Treatment*:

Except in the few cases where the premaxilla is too prominent to allow the clefts to be closed over it, it is much better to leave the septum intact; if any resection has to be done, it should be only of the amount necessary to allow the clefts of the lip to be closed.

Various methods for sectioning and repositioning the vomer, in Georgiade’s experience at Duke University, have led to an unstable premaxillary segment in some patients and eventual "tilting" of the premaxilla lingually with resultant malposition of the permanent incisor teeth in others:

Decreased growth of the premaxillary segment has also been a consideration following wedge resection of a portion of the vomer.

Fara and Hrivnakova noted in 1965 in *Acta Chirurgiae Plasticae*:
A total of 506 patients have been treated for bilateral total cleft at the Prague University Department of Plastic Surgery. In 31 out of 317 cases with marked protrusion of the premaxilla, surgical retroposition was undertaken, mostly as a secondary operation. In most patients this led to damage to the growth of the premaxilla either alone or together with developmental retardation of the entire maxillae. Marked signs of atrophy often develop many years after the operation, in some cases up to 11-13. We must, therefore, regard surgical retroposition of the premaxilla as a risky procedure which should, as far as possible, be made unnecessary by conservative treatment. We consider osteotomy of the vomer as a primary operation in infants to be harmful without exception.

They mentioned their interest in Karfik's suggestion of study of the blood supply of the central segment of the maxilla to consider restriction in development of protrusion of the premaxilla by palliative operations on the arterial network with slight disturbance of the growth zone in its neck.

Bill Holdsworth of St. Thomas' Hospital, London, and Queen Mary's Hospital, Roehampton, in his 1970 edition of *Cleft Lip and Palate*, set two lines, X and Y, for division or resection of the septum in the surgical reduction of the prominent premaxilla. He then summarized rather well:

Among patients who have had the operation [surgical setback of the premaxilla] early in life flat faces abound, and its protagonists are a diminishing band. Matthews uses it only for extreme protrusion. Barsky reported its use in some 50 percent, and in most hands it is reserved for gross and neglected cases. When a child with a double cleft and a prominent premaxilla is not seen until late, closure of the soft tissues, even if possible, may be insufficient to bring the premaxilla into line, and there may be no alternative to surgical reposition.

*Experiments in the hare*

Clinical concern about the middle-third growth of the face is fortified by experimental evidence.

Bernard G. Sarnat of Cedars-Sinai Medical Center, Los Angeles, studied growth of the rabbit snout with A. J. Selman following extirpation of the frontonasal suture in 1957, and with M. R. Wexler after dislocation of the nasal septal cartilage in 1965 and after resection of the septal cartilage in 1966. They
reported growth arrest of the upper face in rabbits after resection of the septovomerine region at four to five months of age and the cartilaginous nasal septum alone at 21 to 48 days of age. Their 1967 report from 18 to 131 days after cartilaginous nasal septum resection revealed a significant early deceleration of growth of adjacent bones. This growth arrest of the upper face leads to a relative mandibular prognathism with malocclusion of the incisors. The deformities become more pronounced in the postoperative survival period.

At the Rome Congress in 1967 Sarnat summarized:

Although it was found that the frontonasal suture was a site of active growth, extirpation of it did not affect grossly growth of the snout. Dislocation of the cartilaginous nasal septum likewise did not affect grossly growth of the snout. In contrast, however, resection of cartilaginous nasal septum produced a severe and striking growth arrest of the snout. From these experiments it is concluded that the frontonasal suture is a secondary or accommodating site of growth whereas the cartilaginous nasal septum is a primary site of growth. This conclusion has important implications and applications in relation not only to the basic problem of the growth of bones but also to the clinical problems of surgery of the nose and palate.

INHIBITION OF GROWTH BY STAPLING

The dapper John Curtin, from the Center for Craniofacial Anomalies, University of Illinois, with Pruzansky, noted at the Melbourne Congress in 1971:

Longitudinal growth studies on more than 50 patients with complete bilateral cleft lip and palate have indicated that overgrowth of the premaxillary-vomerine suture contributes to the characteristic deformity of the mid-face.

Borrowing from the orthopedic surgeons’ technique of stapling across the epiphyseal plate to retard growth of long bones, they devised an instrument and a method of stapling across the premaxillary-vomerine suture. A mucosal flap designed to wrap around the stapling was based laterally on one side with its distal end on the other side. It was elevated without disturbing the
periosteum, the staples were “seated” across the suture and the flap was replaced. Their animal experiments were inconclusive, and the number of infants was too few. Furthermore, the staple often acted as the foreign body that it is and tended to be rejected. Nevertheless, they propose stapling as a possibility, postulating these tempting advantages:

(a) Stapling inhibits growth at the premaxillary-vomerine suture reducing the severity of the deformity; (b) it is a reversible technique; (c) the staple can be removed without injury to bone or periosteum; (d) growth may continue following removal of the staple.

When I first heard of this stapling plan I was hopeful and must admit disappointment that the results so far are inconclusive. I wrote Curtin in June 1973 asking for the latest on his stapling in bilateral clefts, and he scribbled on the bottom of my letter,

Nothing new—still in research form awaiting maturation to substantiate results by “Pruzansky” documentation.

This principle seems to offer an appealing solution to a difficult problem, but as one thinks about it there emerges a major flaw besides the foreign body rejection phenomenon. Ideally, its use should be intrauterine. By the time of birth with the projection already developed it is too late to do much more than what can be done with elastic traction or muscle closure.

PERSONAL STRUGGLE WITH THE PREMAXILLA

My personal experience with the projecting premaxilla has been varied to say the least. At Boston Children’s Hospital in the mid 40’s, I observed MacCollum merely “tweak” the premaxilla with a forceps prior to joining the lip across it.

While still in the Navy in Nashville in 1946, I had the good fortune to scrub on two major surgical procedures a day with William Core, a large general surgeon with a huge practice. Every morning before the U.S.N. Recruiting Office required my services, we did hysterectomies, gastrectomies, cholecystectomies,
thyroidectomies and even an occasional bilateral cleft lip with protruding premaxilla. I was impressed with his speed and skill and, considering his limited plastic surgical training, amazed that he could get these little creatures' clefts closed. Still vivid in my memory, however, is the large round intestinal needle carrying a 0 chromic catgut suture which, having taken a bite through one maxilla and passed through the premaxilla, exited with a dejected tooth bud impaled on its point like a martini onion on a toothpick.

Then during 1948–1949 on Saturdays I visited Kilner at Alton, England. Here I observed bilateral lip clefts closed in two stages without premaxillary setback and a number of wobbly premaxillae excised and replaced with a denture at age five to seven years.

On Tuesdays during this same period I visited the Hospital for Sick Children at Great Ormond Street, London. It was only after several rather trying experiences in heavy fog that I finally located the hospital hidden just off Russell Square. On the eighth floor Denis Browne, renowned pediatric surgeon, was scrubbing for a bilateral cleft lip. He was so much taller than anyone else in the room that at first I thought he must be standing on a stool. His headlight was attached to a battery swinging from his hip so that he need not be plugged to the wall. He nibbled away the “bony overgrowth” between the septum and the protruding premaxilla and, after freshening the edges, set the premaxilla back in the alveolar arch and fixed it with an anterior toothed metal bar.

Between cases I cornered him to ask how he dared take this approach, when many considered the deformity in the underdevelopment of the maxilla rather than the overdevelopment of the premaxilla. He pointed out that in his opinion the vomer was of normal dimensions, but between it and the premaxilla new bone had formed, driving the latter forward. By removing this bone, he was able to replace the premaxilla and obtain union bilaterally in 70 percent of cases—on one side in 100 percent—which he claimed prevented shriveling of the premaxilla.

Then, during my training time in St. Louis, I had a chance to watch Barrett Brown push back a jutting premaxilla and pin it
with a Keith needle. The simplicity of this maneuver was impressive.

When I got to Korea, my first cleft case was a bilateral cleft in which the oral surgeon had already lost the premaxilla.

During my early years in practice in Miami I tried the Brown pushback and did one Gillies partial excision with less than partial success. I then used the Cronin approach or the Burston-Kemahan modification, either of which I favor today if the projection is tremendous. In 1960 my attitude toward the premaxilla was expressed:

There is justified controversy as to what to do with this jutting premaxilla. For the present a compromise is preferable. If the premaxilla is well in the arch, then by turning mucosal flaps a fibrous union can be achieved. If the premaxilla is jutting far out on the end of the nose, then a septal resection, which is designed to affect growth as little as possible and still let the premaxilla back in undercorrected position, seems warranted. Between these extremes are premaxillae protruding varying distances and many can be maneuvered successfully by lip moulding and orthodontics.

At this point our unit was honored by a visit from Burston, and our prosthodontist, George Balber, attempted to follow his directions and produce wedge plates to pound the maxillary elements forward, but without the proper facilities he was unable to duplicate Burston’s results. Then, after a visit by Hagerty and Mylin, Balber began to construct and pin screw plates, which in certain cases, when inserted soon enough, seem to work well. The untimely death of Balber caused this approach to be discontinued.

Meanwhile, and for some time, I had joined forces with Samuel Berkowitz, a Pruzansky-trained orthodontist. He lulled me into a semicoma toward the premaxilla by promising that if I closed the lip over the premaxilla he could spread the maxillary elements later for its reception and bone graft fixation. The buckling of the vomer and the anteflexion of the premaxilla did not seem to cause him great concern. An occasional severely projecting premaxilla has not gone back, and here Berkowitz has been quite amenable to a setback at about five years of age.
AN OUTSTANDING EXAMPLE

Bilateral cleft of the lip with protruding premaxilla but without cleft of the palate was treated in infancy in Alabama with approximation of the lateral lip elements to the prolabium. As we mentioned earlier in this chapter vomer resection was indicated early here to place the premaxilla into normal position. The patient was first seen at 4 years with this frightening projection.

The mucoperiosteum of the vomer stalk was incised and dissected so that a quadrilateral block of bone could be resected from the vomer. Then mucoperiosteum was turned from both lateral edges of the premaxilla and each cleft edge of the maxilla
so that these flaps could be sutured after the premaxilla had been set back. Bone chips from the vomer were used to fill the alveolar gaps between the mucoperiosteal flaps and a Kirschner wire was run from high up in the midline of the premaxilla back to fix it to the vomer.

Patient now needs forked flap medial advancement of the alar bases and lip revision.

Yet to condemn children to suffer with a projecting proboscis, looking not unlike a dog’s mouth or a wolf’s snout, during their early years seems cruel. Determined to bypass this phase, we finally changed our general approach to bilateral clefts in favor of immediate elastic traction to the baby’s headcap. This has been dramatic in some cases and of moderate value in others, but adequate in all so far when seen soon after birth to allow primary lip surgery without the necessity of surgical setback.

When the extreme protrusion of the premaxilla persists and muscle-to-muscle approximation is forced over this projection, it can be accomplished but the ultimate attenuation of the prolabium and stretching of the scars are discouraging. It might be better in such severe cases to bypass this non-profit process with a bilateral mucosal adhesion maintained until better premaxillary alignment facilitates lip closure.
4. Optimum Time for Bilateral Cleft Lip Surgery

**Disagreement** as to the best time for closure has been even greater with regard to the bilateral cleft than with regard to the unilateral cleft. Some of the reasons are similar; some are different. The commonest arguments for early closure have been parental concern, improvement in sucking, avoidance of emaciation from starvation and reduction in premaxillary and maxillary bone gaps. It is interesting that each of these can be controlled effectively today without surgery.

**Keeping the Teeth Out of It**

In 1844 Joseph Pancoast of Jefferson Medical College, Philadelphia, wrote down his thoughts about the age at which the operation should be performed:

This is a point mooted by the older writers and which is not yet so well settled as to lead to uniformity in practice. Dionis, Lassus, Sabatier, etc. deferred the operation till the child had reached its third or fourth year. Sharp, Ledran and Heister advised its performance from a few days to a few weeks after birth. Between the ages of two and four years, children are found so indocile, and so apt, however closely watched, to pull upon the sutures and disturb the process of union, that a great portion of modern surgeons have with good reason recommended the performance of the operation between the second month and the second year after birth. . . . The author gives a decided preference to the period under six months, as we then avoid the necessity of having to extract any deformed teeth, and are less likely to
be troubled with the irritation attendant upon the teeth making their way through the gums, which acts unfavorably on the union of the parts.

A MATTER OF LIFE AND DEATH

Congenial Francis Mason of St. Thomas' Hospital, London, wrote in 1877:

In some bad cases of double harelip, the operation ought, in my opinion, to be done within the first three months, or even earlier, in fact, as soon after birth as possible, in order to save the life of the child.

Modern improvements in general pediatric care, gavage feedings and antibiotics have taken the urgency for survival out of the surgery.

EARLY SURGERY MAY STILL BE THE ONLY HOPE

As in all of surgery, there are extenuating circumstances under which the usual rules must be set aside temporarily so that one can deal intelligently with a specific problem. For instance, in underdeveloped countries the multitude of people often overwhelm all reason to the point that the value of a single lip is not of great concern. An infant with a bilateral lip cleft cannot suck at the breast, and very little ingenuity will be evoked to perpetuate what to the parents is a frightening and monstrous mistake with almost no hope of correction. Thus, such an infant, if not operated on after birth before he leaves the hospital, may never return for a second chance. I have witnessed this tragedy time and again in certain areas of the Orient and the West Indies.

PARENTAL CONCERN

In 1947 Brown, McDowell and Byars in St. Louis stated:

The child with a double cleft of the lip has a very difficult feeding problem, produces much psychic shock to the parents, and incites so many exclamations of curiosity and pity from others that an early closure is necessary. A fairly satisfactory rule is to close it as soon as possible after the baby weighs ten pounds.
Donald MacCollum, who closed hundreds upon hundreds of bilateral clefts at Boston Children's Hospital through the 40's, 50's and 60's, was content to operate at six pounds. Most other surgeons have followed the 10-pound standard of Brown.

Few deformities strike parents with the same shock and shame as a severe bilateral cleft lip does. They are almost frantic in their efforts to have corrective surgery started immediately. For the sake of the child parental concern must be a secondary consideration. Usually if the reasons for postponement are kindly explained, the parents are quite willing to wait whatever interval is suggested. They will get different times and different reasons from different surgeons.

FOR EARLY MOLDING ACTION

Claire Straith of Detroit used to close his bilateral clefts in the first couple of weeks of life so that the muscle band could restrain the premaxilla, as he said, before the premaxilla and vomer had ossified enough to resist displacement.

He felt so strongly about early closure that as late as 1950 he was using local anesthesia to bypass the dangers of non-endotracheal general anesthesia.

A multitude of surgeons through the years have looked to lip closure as the creation of a physiological restraining band. Wayne Slaughter, who trained with Straith, and his Chicago cohorts Brodie and Pruzansky all have confidence in the molding muscle action after lip closure. Slaughter did not operate as early as Straith but postponed bilateral clefts a month or two for the first side and several months for the second side.

Evidently feeling an urgency to operate early on complicated bilateral clefts to restrain the premaxilla without section of the septum, Barros Saint-Pasteur of Caracas in 1964 reported his surgical timing. After blood studies of coagulation and bleeding time, red blood count and hemoglobin, he used local anesthesia for a Veau closure of the lip and anterior palate on one side during the first 36 hours following birth and on the second side 16 to 30 days later. At 15 months the posterior palate was closed and the lip corrected secondarily.
Fara and Smahel of Prague have a more ethereal concern. They believe that postembryonic mesenchymal penetration of the "sterile" prolabium from the lateral lip elements has a better chance if the lip closure is carried out during the early months.

EMERGENCY NO LONGER

In bilateral clefts, the sooner the lip muscles can be joined across the gaps the better. Yet special devices take the *urgency out of the surgery*. An Asepto syringe fitted with 1½-inch rubber tube extension, when placed over one side of the infant's tongue and with the infant in bolt upright position, can facilitate feeding remarkably. Rubber band traction when attached to a headcap can be effective in restraining the projecting premaxilla. This takes the pressure off the need for early surgery, which now can be postponed until the patient is really ready.

PROCRASTINATION RECONSIDERED

There are those who would postpone surgery conscientiously for years and years. This is probably a sophisticated overreaction to the fact that for centuries surgeons obsessed with closing the hole resorted to drastic procedures until eventually dentists, facing unbelievable alveolar distortions, started an anti-surgery protest. Both surgeons and dentists turned to unoperated adult clefts for the answer. Ortiz-Monasterio of Mexico found that in adults with untreated clefts the original deformity *did not increase* during the natural process of growth. Pitanguy of Brazil went him one better by claiming that these cases actually *improved with aging* and had his findings confirmed by Innis in North Borneo and Mestre, Jesus and Subtelny in Puerto Rico. The same is suggested by the unoperated adult bilateral cleft shown here, seen in Jamaica. It is generally accepted, however, in most civilized societies, even by dentists, that patients suffer more from being left with uncorrected facial clefts through childhood waiting a possible improvement than from having them closed earlier by modern *atraumatic* methods.
Skoog of Sweden in 1965 agreed that cleft lip surgery is not an emergency but added:

Surgeons may differ concerning that specific age [for surgery], but this in itself is not an important issue as long as repair is carried out early enough to utilize the existing growth factors for gradual correction of the deformity. This principle of reconstructive surgery is especially important in the case of complete bilateral cleft of the lip and alveolus.

AN "EARLY" CONFLICT

Although most modern surgeons begin operating on the bilateral cleft lip between the early weeks and the third month of age, it is interesting to study the two extremes of this timing as expressed in two books, Stark's 1968 *Cleft Palate* and the 1971 *Cleft Lip and Palate* by Grabb, Rosenstein and Bzoch.

A matter of weeks

DeHaan, for Stark, admitted avoiding the operation during the first 24 hours of life because of the high perinatal mortality but advocated closure in the early weeks.

The very young infant who still has immunity from the mother and high resistance to infection tolerates surgery well and requires minimal anesthesia.

He mentioned other advantages such as solving the sucking problem, protection of the nasopharyngeal mucosa as a deterrent to respiratory tract infections and early union of the orbicularis oris musculature to act as a biological orthodontic band on the premaxillary and maxillary segments. DeHaan cited an example of postponing lip surgery in a 4-pound premature bilateral cleft infant. The tiny patient not only failed to gain weight but developed an upper respiratory infection at two and one-half weeks with loss of one-eighth of his total body weight. Corrective lip surgery at seven and one-half weeks was followed by a prompt gain. DeHaan concluded:

In retrospect, deferring surgery because of prematurity was a mistake, as our pediatric colleagues agree.
DeHaan also strikes down the argument that one should wait for increase in the size of the lip to facilitate closure:

We have not found this to be true and, in fact, feel that the slightly longer lip at the age of 3 months is no easier to correct.

**Or months**

Ray Brauer, for Grabb et al., cited the common causes delaying lip closure:

- protruding premaxilla
- collapse of the lateral palatal segments
- the presence of other congenital anomalies such as congenital deformity of the heart
- and poor general nutrition

Babies with poor general nutrition simply fail to thrive, and until the general nutritional status is one of steady improvement, surgery should be delayed.

Brauer concluded:

Today most surgeons prefer to wait until the child is 2 to 3 months old and weighs at least 12 pounds before starting lip repair. This allows time for sufficient development of the prolabial and lateral lip segments and makes both planning and execution of the surgery easier. During this period, maxillary orthopedic procedures can be used.

**A bit of both**

In a 1970 Russian handbook, A. A. Kolesov of the Moscow Medical-Stomatological Institute stated in reference to the primary lip operation in bilateral clefts:

In the first stage, only one side of the cleft is closed. The first stage in most children can be carried out while they are in the nursery. The other side of the cleft is closed after two to two and one-half months.

**The Preliminary Lip Adhesion**

The simple, quick, bloodless procedure of creating a preliminary minor lip attachment across the cleft makes it possible to achieve some benefits quite early. This of course is the appeal of the adhesion, and its real value, it would seem, lies in its early use.

Bengt Johanson and I employed the preliminary adhesion for
various primary reasons but both of us enjoyed some premaxillary manipulation from our adhesions. Celesnik in 1962 proposed a preliminary alveolar and nasal floor closure at four months of age to be followed with prosthodontic manipulation and definitive lip surgery no sooner than six months later. Randall, at first enthusiastic and now more selective, uses preliminary adhesion in two stages but not until three and six months of age in bilateral clefts. Walker and Collito approximated lip cleft edges without undermining on a conservative combination of adhesion-closure but with good molding of the maxillary segments.

Evidently all of these adhesions and the fear that surgery will stunt maxillary growth led one Austrian surgeon, K. Hollmann of the University of Vienna, to propose in 1973 a sequence of operations with a variation in timing that he has used since 1967. At one week of age he creates an adhesion with mucosal flaps from the lateral lip segments sutured under the inferior prolabium vermilion and lets this stimulate soft tissue growth of the labial stumps in the clefted area.

At one year the soft palate is closed, and not until two years of age is the definitive closure of the lip accomplished.

PRIME TIME

In the rare case with a very severely protruding premaxilla which cannot be positioned properly by rubber band traction or coaxial screw retraction, an adhesion may be the best preliminary maneuver and can be executed at the time of soft palate closure. Yet in most complete bilateral clefts I prefer to bypass the adhesion and achieve the earliest practical one-stage definitive closure in order to create an intact muscle band across both clefts as soon as the rubber band traction from a headcap has reduced the projection of the premaxilla to a reasonable degree. This operation is usually possible at one month or earlier provided the baby is well and gaining weight. I do not feel that Musgrave’s “rule of 10” need be enforced with regard to the 10 pounds in weight in bilateral clefts, but his other standards are essential. As cited years
ago by Oxford's Professor Kilner, at least 10 gm. of hemoglobin and no evidence of upper respiratory infection are essential to ensuring a smooth postoperative course with optimum wound healing.

**Triple Action**

At the time of bilateral lip closure two other aspects of the cleft syndrome, otitis media and cleft palate, are also treated. As usually indicated, the E.N.T. actions of bilateral myringotomy, suction of fluid and insertion of tubes are carried out. A mouth gag is then inserted and as much soft palate cleft is closed as possible by simple edge splitting and approximating with sutures. Early muscle closure of the velum provides at the back of the cleft the same molding contracting muscle action that the lip closure achieves up front. Not only will the velar atrophy of disuse be avoided but there must be beneficial effects from the early coordination of velar and pharyngeal musculature. Thus these two additional procedures, being quick and bloodless and taking so little time from the primary lip operation, are more than justified by the assets that eventually accrue.
5. The Surgical Evolution of Bilateral Lip Clefts

The evolution of the surgical treatment of bilateral clefts of the lip has been influenced by several fundamental factors: the inability of the infant to suck breast or even a bottle nipple, the amount of projection of the premaxilla, the size of the probubium and the shortness of the columna. Yet, even when the palate is intact so that feeding is not quite such a problem and when the premaxilla does not project, when the probubium is of adequate size and when the columna is long enough (rare!), this deformity still presents difficulty.

Most cleft lip surgeons through the ages, with or without good cause, have adapted their unilateral cleft design to bilateral cleft cases simply by doubling it. Many of us at some time have participated in this expedient ruse, but it becomes more and more apparent that it is nonsense. The deformity of a bilateral cleft is not merely a right or left unilateral fissure with its mirror image on the opposite side. It is an entirely different entity with different requirements deserving a different approach.

A BILATERAL BOXING RING

Through the ages, bilateral cleft lip surgery, beset with controversy, has progressed painfully and in spite of many heated battles raging on its every aspect. As already noted, there are numerous ways to deal with the premaxilla, and each has its merits, its discrepancies and its enthusiastic champions. The presence of the
projecting premaxilla and how it is to be handled has always been and continues to be a difficult variable and at the core of some of the controversies. There are such questions as whether to close the clefts in one or two stages and whether to use the prolabium in the lip, in the columella or in both. There is also the question of whether to bolster the prolabium with tissue from the lateral elements, and the variations of design for this aspect are legion.

ONE- OR TWO-STEP CLOSURE

Closure of soft tissue over the projecting premaxilla can be responsible for great tension which increases the chance of disruption. Besides their direct but varied attack on the projecting premaxilla, surgeons have varied their approach to the lip. There are some who prefer to close one side first and wait for healing before closing the opposite side. Yet, there have probably been more surgeons, and just as early in history, who preferred to close both sides at the same time.

THE DESAULT PLAN

After premaxillary compression by a bandage, Pierre Joseph Desault, as early as 1790, advocated surgical closure of both clefts simultaneously, using the prolabium for the central portion of the lip. Translation of Desault's work by E. D. Smith of South Carolina College in 1814 reproduced sketched diagrams of Marie Dehannes, a five-year-old girl with a severe bilateral cleft who was admitted to Hôtel-Dieu, Paris, September 7, 1790. Desault's classic cloth compression bandage was applied before and after the surgery. Once the compression had retracted the premaxilla sufficiently, Desault pared the cleft edges and approximated lip elements with through-and-through needles wrapped with wax thread in figure-of-eight fashion. The compression bandage was reapplied over the suturing until healing by the tenth day. The illustration of the result recorded use of the prolabium in the lip and even sketched the production of a cupid's bow and a philtrum dimple. Both bow and dimple, however, were only a figment of the artist's imagination and the surgeon's dream.
Hotel-Dieu of Paris is probably the oldest hospital in Europe, having been founded about A.D. 651. In the twelfth century it was rebuilt adjoining Notre Dame cathedral on a branch of the river Seine. All extremes of human misery have been suffered within its walls, and at times during the French Revolution it contained 9,000 inmates with as many as eight huddled in a bed with no regard for sex, disease or, for that matter, death itself. Here, through the centuries, cleft lip and palate surgeons have pioneered this specialty. Ambroise Paré served on its staff, as did Blandin, de la Faye and Desault. The Clinical School of Surgery which Desault instituted at Hôtel-Dieu attracted great numbers of students from France and abroad; he frequently had an audience of about 600. Later, Dupuytren became known as the Brigand of Hôtel-Dieu.

Gensoul was responsible for the use of ether, and for the first recovery room in this hospital. In his time, to serve as a surgeon major at Hôtel-Dieu one had to remain unmarried and live in rooms on the premises on a very small salary. Gensoul rebelled against such regimentation and turned the hospital into the “Hotel” its name suggests by charging on the side for the rooms. When his unusual means of increasing personal income was discovered, he was threatened with dismissal. Demonstrating a resourcefulness befitting a plastic surgeon, he evaded the penalty by marrying the administrator’s daughter and continued in service until his expanding private practice made it impractical. Roux also worked at Hôtel-Dieu and did many of his early palate operations there.
A common scene by the side of Hôtel-Dieu, even in the depth of winter, was a group of Augustinian sisters who, having broken the ice on the Seine, were standing up to their knees in the freezing river water washing the soiled hospital linen. Among the sheets, pillowcases and towels would have been Desault’s string head bandages used to restrain and maintain the projecting premaxilla in his bilateral cleft cases.

**MORE CONTROVERSY**

Many early surgeons seem to have followed Desault’s format. Yet the controversy has been and is still being waged, and various regimens gain and lose favor from year to year. In 1939 Fomon reported what he called the general consensus among surgeons at that time but what actually were the teachings of their field leader, Victor Veau of Paris:

>[in] clefts in which the premaxilla protrudes markedly early surgery is imperative, otherwise the bones can no longer be molded by pressure of the reconstructed lip muscle . . . and are best repaired in three or more stages, one side of the lip and anterior palate first, the second side four weeks later, and finally the posterior palate, third.

Veau also noted that

in these complicated bilateral cases, closure of the entire defect at one time is too formidable.

Thus the haste to close had influenced the amount of closure possible.

Brown and McDowell in St. Louis set the premaxilla back and closed both clefts at once while Kilner of Oxford left the premaxilla projecting and closed one side at a time. As Holdsworth of Britain said:

Each cleft is closed at a separate operation with an interval of about one month. The narrower cleft is closed first.

There are many, including the Americans Cronin, Bauer, Trusler and Tondra, who prefer to close one cleft at a time but favor the wide cleft first in order to pull the deviated premaxilla into the midline.
Russian Kolesov in 1970 acknowledged that years ago S. D. Ternovskiy and others recommended a two-stage closure of the lip in bilateral clefts. He then gave his reasons for following this plan:

As the experience of many clinics has shown over many years, closing both sides of bilateral clefts at the same time when the alveolar ridge and palate are also cleft does not obtain a good functional and cosmetic result. The complex anatomical interrelationships of the maxillary bones and the defect of soft tissue interfere with this.

Slaughter, Henry and Berger of Chicago, concerned about the blood supply to the philtrum, feared that the extensive undermining, excisions and incisions of tissue bordering the cleft required for a one-stage closure could be compromising. They stated:

It is, therefore, logical to assume that only one side of a bilateral cleft should be repaired at a time. This allows for a revascularization of the area in a manner compatible with accepted plastic surgical procedures. The double cleft is thereby first converted into a single cleft.

Clarence Monroe of Chicago, renowned for his work on preliminary premaxillary recession in infancy, by 1974 was hedging on this aspect and compensated with:

Where we formerly closed the bilateral lip at a single operation, we now do it in two steps, if necessary.

Manchester of New Zealand and Broadbent of Utah prefer a one-stage closure while for various specific nasal and labial reasons Skoog of Sweden and Guerrero-Santos of Mexico both favor two stages.

It is not of great importance to record each surgeon’s stand on the number of stages he uses for bilateral closure. In 1972 I estimated the probable general percentage and gave arguments for a one-stage closure:

If a poll were taken today, certainly there are surgeons on both sides but probably the two-stagers outnumber the “all in one.” The general regime advocated by Desault—early external compression followed by closure of both sides of the lip at the same time—will eventually be the method of choice. I consider this best because it maintains symmetry and enables better
muscle union across the cleft primarily and eventually more effective 
columnella lengthening. A key factor is the actual craftsmanship of the 
surgeon to accomplish the lip closure in one stage and this is easier than it 
seems.

As it turned out there has been more progress along this line 
than was predicted, probably because of the reasons already noted. 
A survey reported in June 1974 by resident John Osborn of 
Toledo revealed that in 80 residency training programs in the 
U.S.A. and Canada the approach to bilateral cleft lip closure is 
divided, with both sides being approximated at the same time in 
about 60 percent and approximation on one side at a time in 40 
percent.

DESTINY OF THE PROLABIUM

There have been as many fisticuffs over how to use the prolabium 
as over what to do with the premaxilla or in how many stages to 
close the lip. At least Englishman James Cooke of Warwick took 
a positive step in 1693 when he advocated saving the prolabium:

The lip sometimes is double cleft. There remaining only a piece between 
both, which unless it be callous, it need not be taken away.

American Joseph Pancoast, in his 1844 *Treatise on Operative 
Surgery*, logically planned his operation for "double hare-lips" 
around the specific prolabium.

The mode of proceeding in the cure of this variety of deformity will depend 
upon the size of the intermediate part. If it be less than a third of an inch 
broad, and thin, it should be excised near its base, and the operation 
proceeded in as in ordinary cases of single hare-lip.

If the prolabium was larger, Pancoast used it to form the center 
vertical portion of the lip, but if it was short, he was content to 
bring the lateral lip elements together below it.

Since those days the prolabium has continued to be hustled in 
every direction—pushed up into the columella, pulled down into 
the lip, chopped up along each side, high, low and in the middle, 
had flaps stuck along its lower border and even shoved behind its 
backside. This poor, innocent, little soft tissue termination of the
frontonasal component, the oyster of bilateral clefts, has been exploited in so many ways by so many surgeons that one is tempted to allegorize the probium in the words of Lewis Carroll. Like any couple of surgeons in a cleft palate clinic—and that could be Dieffenbach and Langenbeck, Franco and Paré, Kilner and Peet or any of us today—

"The Walrus and the Carpenter
Walked on a mile or so,
And then they rested on a rock
Conveniently low.
And all the little Oysters stood
And waited in a row.

\ldots \ldots \ldots \ldots \ldots

'Now, if you’re ready, Oysters dear,
We can begin to feed.'

"'But not on us!' the Oysters cried,
Turning a little blue.
'After such kindness, that would be
A dismal thing to do!'

\ldots \ldots \ldots \ldots \ldots

"'I weep for you,' the Walrus said;
'I deeply sympathize.'
With sobs and tears he sorted out
Those of the largest size.
\ldots \ldots \ldots \ldots \ldots

"'O Oysters,' said the Carpenter,
'You've had a pleasant run!
Shall we be trotting home again?'
But answer came there none—"
Prolabium to

Nose
  - Columella
    - Primary
    - Secondary

Lip
  - Simple side-to-side
    - One stage
    - Two stages
      - Lateral flaps below prolabium
        - Long rectangular
        - Quadrilateral
        - Triangular
      - Lateral flaps above prolabium
        - Triangular (R-A)
      - Lateral flaps interdigitated into sides of prolabium
        - Triangular
        - Quadrilateral

Both nose and lip
  - Primary
    - As forked flap
      - Columella
      - Banked in nasal floor
      - Columella
    - As transposed flap across columella base
      - Two stage

  - Secondary
    - Midvertical V-Y advancement to columella
    - Nasal floor and alar base advancement into columella
      - Forked flap
        - Columella
      - Banked in nasal floor
        - Columella
      - Transposed flap at columella base
        - Columella
For well over a century a scattered band of surgeons, small in number but none the less dedicated, have sympathized with the plight of the nose and have maneuvered the prolabium up into the columella. Reviews of the champions of this approach reveal that it has been predominantly a French trick. With this small soft tissue termination of the frontonasal process so completely a part of the depressed nasal tip and in the absence of a columella, it seemed to some the expedient thing to do. Then, when histologists began reporting no orbicularis oris muscle in the prolabium, the argument grew stronger for a nasal destiny for this "muscleless" tag.

Georges de la Faye of Paris in 1743 wrote Observations on Cleft Lip which has been translated by Mary McDowell for The Classic Reprint in Plastic and Reconstructive Surgery 1976. His first bilateral cleft lip operation was carried out in 1733 in the presence of several elite surgeons such as Francois de la Peyronie of "Peyronie's Disease", Jean Louis Petit of "Petit's triangle" and "Petit's hernia" and Sauveur Francois Morand of cleidocranial dysostosis. In front of this austere audience de la Faye removed the pre-maxilla and brought the lateral lip elements together behind the prolabium which he left hanging free on the end of the nasal tip. He held the lip elements together with 2 pins, one passed up near the nose and the other down near the edge of the lip. Over these pins he wound strands of silk in figure-of-eight fashion. As he explained,
The pins I used were the German ones—flexible, long and slender; they are better for this purpose than pins of gold, silver or steel (and better than those one calls "larding pins").

Georges de la Faye discussed relaxing incisions sensibly.

When the separation of the two parts of the lip is very wide, Celsus, Quillimeau, Thevenin, etc. advise . . . that one make an incision on each cheek in the form of a cross. Some others prefer in such a case, to make incisions inside the mouth. However, the incisions in the cheeks produce a deformity from the scars which I think useless.

He reinforced the pins by crossing linen bandages under the nose and fixing them to the cheeks with plaster of Andrew of Cross. For postoperative treatment he reported

A slight fever the next morning obliged me to bleed him.

All pins were removed by the 9th day but the linen bandage maintained. His evaluation of his result is pertinent.

On this lip there is still a very small cleft which is the result, not of a faulty union, but because I could not cut close enough to the mounds. (These mounds are semicircular and it is necessary to cut into them if one wishes to unite the lip without leaving any cleft.)

In 1839 in Paris Baron Dupuytren excised the premaxilla but used the prolabium to form the columella. Having dispensed with the obstructing premaxillary nob he was able to pull the lateral lip elements together beneath the prolabium in a midline vertical closure. One cannot but flinch at what must have been the flatness of these final faces.

Even his Parisian colleague, Malgaigne, attacked him for discarding the premaxilla with the tooth buds but joined him in his columella lengthening. Malgaigne used Desault’s preoperative cloth compression repositioning of the premaxilla and then shifted the prolabium into the columella.

LORENZ

Another French surgeon obviously obsessed with the short columella and depressed by the flat nasal tip was Lorenz, who in
1907 slid the prolabium into the columella and closed the lip segments in the midline beneath it. Not only did the side-to-side tension of the lip closure produce a tight lip but in time the lip became abnormally long in the vertical dimension. With any finesse it would seem that a surgeon should be able at least to improve the nose by feeding needed tissue into the deficient central zone of the columella. Yet here are a couple of cases presented by Veau of Lorenz' technique in which neither the lip nor the nose had benefited by this radical shifting of the prolabium.

**OMBREDANNE**

Renowned French surgeon Ombredanne was reputed to possess a great black beard in his later years which, when preparing for surgery, he parted in the middle and tied up over his operating cap. He reversed this principle with the bishop's cap redundant foreskin in the treatment of hypospadias. In 1934 he mimicked his beard and the bishop's cap principle in bilateral lip clefts by shifting the prolabium up into the nose and suturing the lateral
lip elements, with assistance from the cheeks, together in the middle beneath it. The result was an excessively long lip. Obviously Ombredanne made more of a contribution in hypospadias than he did in cleft lip.

**LINDEMANN**

German oral surgeon August Lindemann had such overwhelming early experiences during World War I on wounded jaws that he wrote a book which was obtained and used even by Gillies in the enemy camp. In 1941 he advocated utilization of the prolabium of bilateral clefts for the columella and designed the shifting of "war-like" nasolabial cheek flaps to assist the lateral lip elements in the construction of the upper lip. This procedure, of course, created the same vertically long upper lip as seen in the French renditions.

**FORKING IT**

It is interesting that in 1967 Rio’s Ivo Pitanguy advised the same proportioning of tissues in Brazilian adults with unoperated bilateral cleft. His modification bisected the entire prolabium into a “forked flap” and advanced most of it along the septum into the columella. Then, with the aid of circumalar incisions, he approximated the lateral lip elements together in a midline union without a philtrum. The freed alar bases join the tips of the prolabial forks much as I have described in a modification of the original standard forked flap.

**GABARRO**

Another champion of moving the prolabium into the columella is Catalanian Pere Gabarro of Barcelona, who was with Gillies during World War II and learned to be daring with flaps! He also developed the chessboard grafts for the war burned. We became friends in 1948, and I wrote in “Plastic Peregrinations” in 1950:

Hitch-hiking in Europe is an interesting method of travel. It may mean anything from the front cushion of a Dalahaye to a sack of onions in the
back of a truck. . . . In this rather undignified but pleasant manner I proceeded south into Spain and in Barcelona knocked at the door of Dr. Pere Gabarro. I had hoped he would appear in a black flat hat and red cape and proudly display a collection of Miura bull horns on his office walls. As it turned out, Gabarro, although a sportsman and enthusiastic mountain climber, has never seen a bull fight and was horrified at my description of the six bulls finished off earlier that evening in the arena.

In 1967 Gabarro, having had to correct secondarily the short columella in a multitude of bilateral clefts, advocated shift of the prolabium as a primary procedure. Often feisty, he completed his paper with a typical flourish:

I like to finish . . . by saying that I think I have proved:

1. That it is not necessary to use the soft tissues of the prolabium for the reconstruction of the central part of the lip.
2. That it is better to use the prolabium to build up a proper columella from the very beginning, avoiding the pitfall of a short columella and the lowering of the tip of the nose.
3. That the triangular flap from one or both cheeks at the same time, may give us all the necessary and proper tissue for the reconstruction of the lip, its central part included.
4. That because those flaps can be raised at the same time from both cheeks, repairs which were advised to be done in two stages, can be done in one operation with this technique.

In 1974 Gabarro wrote:

The cheeks are very good areas to provide for the necessary tissues for the reconstruction of the lips, without much damage to the donor area. . . . In cases where there is a big defect, to try to cover it with a very limited local plasty, may not be so successful. . . . I believe, as Kilner did, that the prolabium belongs rather to the columella than to the central lip. Let me tell you about one of my cases which is a dramatic example of this approach. A girl, 14 years old, came to the out-patients clinic at the "Hospital de la Sta. Creu i de St. Pan" in Barcelona dressed in black, like her mother, dirty and looking like the worst possible hippies. The girl holding tightly the hand of her mother, crying and trying to hide her face into her mother’s skirts. She did not want me to see her.

Gabarro used his method to lengthen the columella and close the lip.
Honest John Potter of Stockton-on-Tees in the Newcastle region in 1968 attributed much of the bilateral nasal problem of flattened nasal tip, short columella and wide nostrils to the fact that "the pre-maxilla bulges into the nostrils." He predicted that after any standard surgery there would be "obstruction of the airway and a chronic catarrh."

Experience with a complete bilateral cleft of the lip and palate with a pigmented epulis involving the premaxilla had forced him to remove the front of the premaxilla during the tumor excision. The result was an early, better than usual, nasolabial angle which inspired Potter to simulate this approach in the standard projecting premaxilla.

Thus, in 1963, he operated on a new case which did not have a severely projecting premaxilla. He attacked the premaxilla by removing its anterior plate in the upper two-thirds, tooth sacs and central septum to bring it back in relation to the nasal spine. He then shifted the prolabium partially out of the lip and into the columella, bringing the lateral lip elements together in the midline.

Potter was genuinely encouraged three years later by the nasal improvement in flatness and the lack of obstruction, as he expressed in the *British Journal of Plastic Surgery*, April 1968. As he
had avoided nasal obstruction, he cited Proetz’ 1953 work as further defense of this approach and elaborated:

Because the air passages are distorted, deposits occur on the nasal mucosa beyond the obstruction. This causes local drying, a loss of cilia and consequent infection. There is a chronic condition of discharge and frequent acute exacerbations. Usually these children are mouth-breathers with a chronic nasal discharge.

As taught by his chief, Wardill, Potter followed his case faithfully and, although still convinced that the gain had been worth the price, he candidly expressed regret over the loss of the upper incisors and the retroposition of the premaxillary area, probably requiring an Abbe flap. In fact, an Abbe flap must have been used subsequently, as suggested by the donor scar, but evidently was too small to construct an adequate philtrum. A 10-year follow-up kindly forwarded by Potter is available for your evaluation.

SKIN GRAFT TO THE PROLABIUM DEFECT

British-trained Jack Penn of Johannesburg, South Africa, sculptor, six-day Israeli war expert and wild animal reserve guide, conceived a way to poach the prolabium for the columella and avoid a serious price of this action: lip tension. His observation when teaching cleft surgery is provocative:

Remember, a cleft palate is also a cleft nose, and its correction is equally important at a very early stage. This applies to the flattening of the nostril in...
the unilateral cleft and to the shortening or loss of the columella in the bilateral cleft. I deal with both of these problems at the first stage of three months.

At the Melbourne Congress in 1971 Penn proposed his way of dealing with the problem of the flat nasal tip in the bilateral cleft. He advocated moving the total prolabium into the columella, joining the turndown flaps of lateral lip vermilion to form a free border and suturing the mucosal edge of the lateral elements to the mucosal edge of the premaxilla. This procedure leaves a defect of the philtrum backed by the raw premaxilla posteriorly. Penn covers this area with a full-thickness free graft of posterior auricular skin, which he maintains will give a philtrum appearance and maintain a short upper lip. He also mentioned that this graft can later be elevated and grafted behind to form a labial sulcus. For those who think that the orbicularis oris muscle is important, he gives this assurance:

The fact that there is no muscle in the prolabial element does not interfere with the function or the appearance of the lip.
The fact that Penn received a major portion of his plastic surgery training from Sir Archibald McIndoe, who himself was renowned for his free skin grafting of burned Battle of Britain pilots, probably explains this unusually demanding performance of a free skin graft. The three interesting cases included here, forwarded by Penn from South Africa, although they are relatively early results, do indeed show a nose with the tip well up. It is important, however, to note the possible discrepancies of such an approach. In the male, it is not so much that the hair-bearing prolabium might produce a "bristling" columella as that the newly grafted philtrum will be noticeably bald. The lack of labial sulcus is unfortunate, but even with a skin-grafted one secondarily there is a most serious diastasis of the orbicularis oris muscle and the likelihood in time of severe flattening and horizontal spreading of the muscleless philtrum.

In general, the prolabium's primary duty must be to the lip. To shift it totally into the columella may offer a definite dividend to the nose, but this is overshadowed by the loss to the lip. Joining the composite lateral labial elements together in the midline with one vertical scar produces a bizarre lip shorn of its central philtrum. The side-to-side tightness will give an inartistic flatness which eventually will result in a long lip in the vertical dimension. If no attempt is made to join the muscles, the lack of muscle continuity becomes the deformity. Neither is natural.
In bilateral clefts without premaxillary protrusion it does not take much imagination to think "lip" for the prolabium. It is sitting demurely between the lateral elements, and to join the three seems quite logical. If the premaxilla protrudes in front of the maxillary elements, carrying the prolabium farther away from its lateral counterparts, the solution is not so obvious. And when the prolabium is actually projecting off the tip of the flattened nose, it is easy to sympathize with those surgeons who, in desperation, used it as a columella to satisfy the nose and were willing to pull "like hell" to get the lateral elements joined to each over the premaxilla.

Of course the early surgeons merely chopped off the premaxillary knob in an expedient ruse to facilitate lip closure. This was Franco's approach in the sixteenth century, but he had the ingenuity to undermine the lateral lip elements and to incorporate the prolabium in the lip.

Georges de la Faye of the Royal Academy of Surgery, Paris, whose portrait has been obtained by courtesy of the Boston Medical Library in the Countway Library, wrote about his operation for bilateral cleft lip in 1743. Translation of his work by Mary McDowell for The Classic Reprint in Plastic and Reconstructive Surgery, 1976, indicates that his second operation was a more classical design incorporating the prolabium as the center of the reconstructed lip. He noted,

I did not remove any of the jaw, because none projected

and proceeded to attach the lateral lip elements to the sides of the prolabium and transfix them with pins wrapped with silk in
figure-of-eight fashion and reinforced with linen bandage. He bled the boy postoperatively several times for fever and reported Twenty days later the lip was all perfectly healed; the scar was in the shape of a Y.

The accompanying commentary by editor Frank McDowell as always was interesting.

By de la Faye’s time surgery, even plastic surgery, had come in out of the streets and become a respectable occupation—one suitable for gentlemen who wore powdered wigs and truffles and had portraits made. Moreover, the elite knew each other, then as now, and on occasion they watched one another operate.

In 1842 in New York, J. Marion Sims also removed the premaxilla but preserved the prolabium for the central portion of the lip. At a second operation five weeks later, he pared the lateral lip and prolabial edges, brought all elements together, and fixed them for one week with a single interrupted suture across each cleft, further stabilized with a through-and-through needle.

In 1844 Joseph Pancoast of Philadelphia expressed preference for use of the prolabium as the full length of the lip.

The patient is to be seated in a good light, with the arms and feet well secured, and the head pressed against the chest of an assistant, who with his hands compresses the facial artery of each side under the edges of the jaw, and with the thumb pushes the cheek in toward the midline... If the intermediate substance be a larger dimension it must be preserved, as it will be of great importance in the reconstruction of the lip... The operation may be completed at once... by detaching the frenulum, paring the edges of the middle portion... excising the margins of the two lateral portions—and introducing the pins so as to bring fairly together the four raw surfaces, causing one or more of them to traverse the middle portion.

In 1877 Francis Mason of Grosvenor Square, London, described the method of Sedillot, which, aided by removal of the premaxilla, incorporated the prolabium as a V in the full length of the upper lip, bringing only the mucosa of the lateral lip elements together in the midline. William Rose stated in 1891: I cannot but think... that the nasal distortion is less easily remedied by this plan.

108
It required both insight and courage for early surgeons to save the obstructing premaxilla and still incorporate the prolabium into the central portion of the lip.

In 1897 Julius Wolff realized the importance of pressure from the united lip to retropose the premaxilla. He also advocated use of the entire prolabium for the full length of the central upper lip.

In 1844 Joseph-François Malgaigne of Paris wrote *Du Bec-de-Lievre*, which was translated from the French by Robert H. Ivy and published as a classic reprint for *Plastic and Reconstructive Surgery*. His portrait from F. H. Garrison’s *History of Medicine* shows him as a young man.

Using the standard approach of his day, Malgaigne pared the edges of the cleft and used pins to approximate them but was constantly disappointed by the resulting notching. He wrote

For double harelip the atrophy is still more striking; generally, the median lobe of the lip is shorter than the other sections, and it cannot contribute to reconstruction of the labial border; the median notch is, therefore, much deeper than in unilateral cases.

He was first to conceive and publish the cutting of flaps off the edges and using these to prevent notching.

As he said,

In a word, the freshening of the harelip should only be done by cutting from the skin a few parings—and it is the utilization of these lost cuttings that constitutes the new method. I say method, with the understanding that the harelip operation which is now classified as chielorrhaphy becomes so transformed that it enters the classification of cheioplasty. Instead of becoming a seam, it adds a piece. . . . If one were dealing with a double harelip, it is easily understandable how one could, for the creation of a median tubercle, take advantage of these two floating flaps which will always offer more than the necessary amount of substance.

It later was brought to Malgaigne’s attention by Roux that M. Clemont of Rochefort had described to him a similar operation. As explained by editor Frank McDowell, there had been no illustration in Malgaigne’s classic article and the diagram shown here labeled “Clemont-Malgaigne procedure” was published later in a book by Broca.
Two champions of the general principle of incorporating the prolabium in the full vertical length of the upper lip were George Van Ingen Brown and Matthew Federspiel. Both held M.D. and D.D.S. degrees, both wrote books, both worked in the Milwaukee area—Brown at Children’s Free Hospital and Federspiel at Marquette University. They were keenly competitive, each jealously guarding his own variations in technique to the extreme of barring the other from his operating room.

G. V. I. Brown’s air of pomposity led followers of Federspiel to refer to him as “God vainly imitates” Brown. He designed a simple bilateral lip closure in 1918 that maintained the entire vertical length of the prolabium including its vermilion and incorporated it into the central upper lip.

In 1927 Matthew Federspiel published his method, which incorporated the entire prolabium into the center of the upper lip. Also, he modified the method by discarding the prolabial vermilion and transposed lateral vermilion flaps across under the prolabium to form the free border. He interdigitated these flaps in an attempt to create a cupid’s bow.

Too few cases were published to allow evaluation of his method, but the principle of his variation has merit. In the past, Federspiel has been maligned unjustly by some surgeons, including myself, as it had been taught that he was a prime advocate of
the miserable principle of introducing lateral flaps *including skin* beneath the inferior border of the prolabium. Actually, his flaps were only mucosa, and an apology is herewith offered for this misunderstanding.

**VEAU III**

During his time, Victor Veau had a greater influence on lip and palate surgery than any surgeon before him. He was the “big name” among the surgeons who incorporated the entire prolabium as the central vertical component of the upper lip. In his 1938 book, *Bec-de-Lièvre*, Veau described in detail the application of his unilateral closure in bilateral clefts. In the incomplete bilateral cleft he maintained the mucocutaneous junction plus a small cuff of vermilion on the inferior border of the prolabium and brought lateral vermilion flaps together below it. He used a wire retention suture to encompass the muscle of each lateral lip element, passing it through the muscleless prolabium and tying it posteriorly without freeing the prolabium or bringing the muscles together.

Incorporation of the total prolabium in the lip caused the nasal tip to be dragged down by the short columella.

In complete bilateral clefts Veau operated first at from two to five months of age and closed one side at that time, including the anterior palate cleft, with his method. This involved turning a
flap off the vomer like the leaf of a book and suturing it to the freed mucosa of the lateral edge, then overlapping this closure with a mucoperiosteal flap for a partial second layer. Three months later he closed the second side. Other points of interest in his method were that he did not section the vomer, he did not free the prolabium from the premaxilla and he placed great emphasis on his “métallique suture musculaire,” which passed over the anterior premaxilla, picked up the lateral lip muscle and, when tied, relieved the tension of the closure. Of course, the volume of his cases was fantastic, and the results shown in his book revealed a reasonable lip with an occasional “whistling deformity.” Yet, invariably, the short columella had resulted in an extremely depressed nasal tip.

When I visited him in 1948, I confirmed these same observations.

Here is a similar case treated along the same principle by Milivoj Perko of Zurich. First orthodontia was instituted by Margaret Hotz. Then a Celesnik adhesion of the alveolar area and nasal floors was followed by a second-stage Veau-type lip closure.
About the same time, in 1941, the great German surgeon Georg Axhausen also used the entire prolabium for the center of the lip. After sectioning the vomer and retroposing the premaxilla, he closed the lip in one or two stages. His technique emphasized closure of the nasal floor and constructed no upper sulcus by avoiding freeing the prolabium from the premaxilla. He maintained the inferior prolabium vermilion and, in a variation from other methods, conserved as well the lateral prolabial vermilion as flaps based distally which he used to bolster the lateral segments. This bilateral operation gained some popularity in certain parts of Europe.
It is interesting that the first to describe this lateral transposition of mucosa from the prolabium was an Englishman named Smith. In the December 28, 1867, *Lancet* Thomas Smith presented a method for bilateral clefts of the lip in which he pared mucosal flaps from the sides of the prolabium based inferiorly and inserted them into mucosal releasing incisions along the lateral lip elements. Rose commented on this approach in 1891:

Evidently it can only be of use where the soft tissues are abundant.

**VAUGHAN**

Harold S. Vaughan, who came to the United States from Nova Scotia in 1889, preceded Ivy at the University of Pennsylvania School of Dentistry by two years, received his M.D. from the College of Physicians and Surgeons of Columbia University and lived for an active 93 years. A note to Ivy from Vaughan’s granddaughter Catherine is enlightening:

Grandad was a man of genius and eclectic interests. A rugged individualist and Nova Scotian through and through, he succeeded at whatever he undertook—painting, etching, horticulture, the study of business and finance. . . . He understood profoundly the human character. . . . His sense of humor was subtle and extremely teasing. . . . He loved arguing . . . did not believe in idle flattery . . . a very human human being.

This Harold Vaughan of Columbia University in his 1940 book agreed with G. V. I. Brown and Warren Davis of Philadelphia that the lower prolabium vermilion should form the central border of the lip. His method incorporated the prolabium vermilion in part but overlapped lateral vermilion to fill out the tubercle. This is a general approach that is still popular in many clinics today.
Ternovsky

An early Russian surgeon, S. D. Ternovsky, in the spirit of Veau, Brown and Vaughan included the prolabium, its inferior mucocutaneous junction and a small cuff of vermilion as the central portion of the lip. He brought the vermilion of the lateral lip elements together in the midline below the fringe of prolabium vermilion.

Through-and-Through Straight-Line Closure

In all of these early bilateral clefts in which the prolabium was used to form the full length of the upper lip a through-and-through straight-line closure was used bilaterally. The scars are unimaginative, unnatural and partly responsible for some of the well-known secondary stigma of bilateral clefts. Yet as late as the early 1970’s two plastic surgery giants with impressive bilateral cleft track records have come to opposite conclusions.

Tom Cronin with Penoff in Texas in 1971 emphatically stated his preference for the Veau III or straight-line closure with preservation of the prolabium ridge, claiming:

It is simple, forms a cupid’s bow, and is not difficult to revise. There is a tendency for lack of protrusion of the vermilion border.

Ray Broadbent with Woolf in Utah in 1972 enumerated the disadvantages of the standard straight-line closure:

Additional experience with the straight line repair (20 cases) reaffirmed the old problems of a straight scar—often associated with a grooved nostril floor (presenting the dirty nose appearance), a whistling deformity with an adherent prolabium.
As late as 1974 Donald Kapetansky of Southfield, Michigan, advocated simple, total incorporation of the prolabium in the center of the lip. His one modification was preservation of cleft edge parings, including vermilion and skin, as lateral flaps based superiorly. During the side-to-side approximation of the freshened lateral lip elements to the prolabium these side flaps (L) were inserted bilaterally into a membranous septal incision “to relieve tension of the upper lip.”

Kapetansky is not concerned that the result of such an operation will present a short columella, flaring alae, spread prolabium with bulging lateral lip elements, lack of muscle continuity, absence of an upper sulcus, visible preservation of bizarre prolabium vermilion and a whistling deformity.

He is content to wait until five years of age, at which time he advocates his effective muscle transfers by bilateral pendulums followed with a columella-lengthening procedure and nostril correction, either by Millard flaps or by Cronin nostril-floor pedicles.

AN ANATOMICAL ARGUMENT FOR THE PROLABIUM IN THE LIP

The vomeronasal organ was first described by Ruysch in 1703 and finally in 1811 by Jacobson, a Dane, for whom the organ was named. It has been claimed that phylogenetically and embryologically the prolabium represents the rudimentary organ of Jacobson, and, as the latter is part of the nose, the prolabium belongs at the lower septum to aid in the formation of the columella. In New York Stark and Ehrmann proved otherwise when they found, out of six embryos with cleft lip and palate,
only three with the organ of Jacobson, and even in those three it was 1.0 to 1.5 mm. posterior to the cutaneous surface of the lip. Thus the conclusion was that neither prolabium nor premaxilla is the seat of Jacobson’s organ in bilateral clefts. Coexistence of a well-defined Jacobson’s organ far posterior in the nasal septum to the well-defined prolabium precludes such a possibility, and the absence of the organ in the prolabium of embryos further vitiates the claim. In 1958 Stark with Ehrmann confirmed use of the prolabium in the lip program:

The prolabium is a lip structure. It should be used in its entirety as the central lip element in repair of bilateral cleft lip. If the prolabium alone is used a normal philtrum will develop. If the prolabium is placed onto the nose as columella, the columella will be hirsute in the male, and the lip will be greatly elongated and will develop bereft of its philtrum.

In general principle, use of the prolabium as the central figure of the lip is sound as far as it goes and is the basis of most modern methods today. Yet to insist that it be used in its entirety and only in the lip and that it form the total central vertical portion of the lip is shortsighted! Eventually the columella must be lengthened, and the prolabium, which may be too wide originally or as a “muscleless blob” later stretched too wide, can share in the columella lengthening either primarily or secondarily. Then, too, in order to form the entire vertical length of the lip, the prolabium’s inferior vermilion and mucocutaneous junction must be preserved as such and this often leaves much to be desired.
8. Transposition of Lateral Flaps
Below the Prolabium

Many cleft lip surgeons of the last half of the nineteenth century and the first half of the twentieth, conscious of the overall vertical shortness of the frontonasal component, focused primarily on what appeared to be a short inadequate prolabium. As Pancoast stated in 1844 in reference to the handling of the prolabium in bilateral cleft lip:

If the middle portion, as is very commonly the case, should not be long enough to reach the labial margin, the wound left after the introduction of the hare-lip pins will have the shape of the letter Y.

Bolstering the prolabium from below with skin flaps from the lateral lip elements seemed to realize two immediate assets: (1) The prolabium was lengthened; (2) because the prolabium was not forced to form the complete vertical length of the center of the lip, less downward pull was exerted on the entire frontonasal component, permitting the base of the short columella to ride a bit higher with an insignificant release of the depressed nasal tip. The result was a kind of labial and nasal communal sharing of tissue, neither component being satisfied. This tempting compromise with apparent but inadequate advantages encouraged a host of surgeons over a century to adapt in the bilateral cleft by doubling their unilateral lateral flap. As it turned out, this principle, not being correct in unilateral clefts, compounded their error in bilateral clefts, the damage being far more than twice as much.
William Rose of King’s College Hospital, London, in 1891 described his approach to bilateral cleft lip, which, as he wrote, should be carried out according to the principles enunciated for the single harelip operation. . . . The central tubercle is pared in a V-shaped manner, and the lateral segments by curved incisions from above down to the mucocutaneous junction, and then obliquely upwards and inwards. Only the apex of the central portion is included in the completed lip. The long cross lines represent the position of the wire stitches, and the short ones of the catgut sutures.

He advised lateral undermining:

A free detachment of the lip from the maxillae by undercutting should be the first step, and this must be accomplished thoroughly in these bilateral cases.

Rose also defended the logic of his use of the prolabium:

The treatment of the central part of the upper lip demands special notice. In the first place, it is quite evident that to attempt to draw it down to any extent between the flaps would have the effect of depressing the point of the nose and producing an unsightly lateral dilatation of the nostrils, for it must be remembered that this stunted portion of tissue represents in most cases not only the central part of the lip, but also the columna nasi. . . . Consequently, it is only the extremity of this philtrum which needs preparation, and this is effected by cutting it into a V-shape. . . . The outer segments can then be brought together in the median line.
There was a similarity between Rose's approach and the later Thompson method.

![Thompson, 1912](image1)

Then Binnie designed an even more frightening procedure.

![Binnie, 1916](image2)

One-stage Veau II as diagrammed by W. G. Holdsworth, 1951

**BARSKY**

Arthur Barsky has long been known for his teaching. According to Bernard Simon, one of his students, Barsky's philosophy was exemplified by the saying:

Give a man a fish and he will eat for a day. Teach a man to fish and he will eat for a lifetime.

At New York Mt. Sinai Hospital, while treating the Japanese girls burned in the Hiroshima atomic bombing, he took the precaution of having two teams of Japanese surgeons working
with him. Then in 1966, acutely aware of the ravages of war, he followed the old proverb

*It is better to light a candle than to curse the darkness*

and started Children’s Relief International. He designed, built and staffed a children’s hospital in Saigon devoted to the treatment of victims of war and congenital anomalies, with the ultimate plan of eventual Vietnamization.

Arthur Barsky’s early training with J. Eastman Sheehan, who he said “would try anything, sometimes not always advisable,” plus his own skill and zeal for teaching possibly backfired in a minor way in bilateral clefts. In his good 1938 book Barsky published a bilateral lip design which achieved union of the lateral skin and vermilion flaps beneath the inferior edge of the prolabium after repositioning of the premaxilla by the method of von Bardeleben.

From 1952 for many years, Barsky was Chief of Plastic Surgery at Mt. Sinai Hospital and later at Albert Einstein Hospital. His teaching in the New York area had great influence on many surgeons treating bilateral clefts and was partly responsible for perpetuating this unnatural approach. Finally, in 1964, in a book with Sidney Kahn and Bernard Simon, he changed the design slightly, calling it the Barsky-Hagedorn operation, and made special mention that the lateral flaps were rectangular in shape. The prolabium vermilion was used for lining if needed. As the principle remained the same, so did the results.
BLAIR AND BROWN

The majority of cleft lip surgeons, as previously mentioned, with or without good reason, had been forcing their unilateral designs on bilateral clefts with more or less unsatisfactory results. When Blair modified Mirault and Brown modified Blair, most surgeons joined the St. Louis "bandwagon" and along with Brown introduced a pair of triangular flaps under the inferior border of the prolabium.

In 1947 Brown, McDowell and Byars admitted that the surgical repair of double cleft lips is about twice as difficult as in single clefts and the results are about half as good.

In principle, they stated,

The prolabium is the central segment of the lip and must be used in this position in the closure. The upper part of it is sometimes advanced secondarily into the columella at three or four years of age, but it is best not to do this primarily.

Many of the features of the modified Mirault operation for single cleft lips were adapted for closing the double clefts.

They described variations:

When the prolabium is unusually large or long, so that the Mirault flaps under it might result in too long a lip, 2 or 3 mm. of skin can be excised from the bottom of the prolabium to shorten it. If the prolabium is tiny, the lateral flaps may be designed in a rectangle to elongate the lip.
In 1966 Frank McDowell reviewed six late cases of bilateral clefts (13 to 23 years) treated by the 1947 Brown-McDowell-Byars double triangular flaps. In reference to incomplete bilateral clefts he stated:

These are probably the most difficult of all cleft operations. Partial double clefts have attenuated vermilion generally placed in the wrong direction, and a great tendency for single or double whistling deformity to result.

In complete bilateral clefts, when compared to the original deformity, the late results were reasonable. The lip lacked a cupid’s bow and natural contour, but because of the smallness of the triangular flaps at least the lip was not usually too long in vertical dimension. Either the columella was a little short of ideal or it had been elongated to near normal length at the expense of a midline lip scar left in its wake. McDowell did admit:

Occasional patients will have tight upper lips and loose lower lips in spite of all surgical intentions to the contrary, and improvement will result from cross-lip flaps.

This simplified Brown-McDowell-Byars approach, taught with blue-dot clarity, attracted students from all over the world, and many have clung to the method ever since. Fogh-Andersen was in St. Louis in 1950 when I was, and evidently Barrett Brown’s dogmatic teaching was deeply ingrained. Over all these years he has had a monopoly on the clefts of Denmark and, having never veered from the double triangular flaps, now has a 20-year controlled series. If you wish to see how bilateral clefts were once treated in St. Louis when it was the cleft lip mecca, take a trip to wonderful, wonderful Copenhagen.

In 1959 Bauer, Trusler and Tondra, having used the “Brown” approach for years, cited horizontal and vertical shortness with vermilion thinning in late results, which finally forced them to discard this method.

Padgett and Stephenson in 1948 at the University of Kansas School of Medicine endorsed the same principle but advocated the Mirault-Blair design, which placed more skin beneath the prolabium.
W. G. Holdsworth in 1951, while still at Rooksdown House, Basingstoke, diagrammed what he called a one-stage Veau II, noting:

This operation is feasible if there is little nasal deformity.

LEMESURIER

Following his dramatic entrance on the plastic surgery scene in 1946 with the Hagedorn quadrilateral flap in unilateral cleft lip, A. B. LeMesurier began to apply the same principle by doubling it against the prolabium in bilateral clefts. Theoretically, shaping the distal end of each lateral quadrilateral flap slightly wider could produce the effect of an artificial cupid's bow and gave the method a slight edge over other similar procedures.

Evidently LeMesurier did not use this trick and actually kept his lateral flaps extremely narrow. Surgeons who were pleased with it in single clefts quickly adapted it to double clefts. The criticism of this approach was the same as of all other methods which employ lateral skin flaps transposed below the prolabium. It left unnatural scars and inferior transverse narrowing of the lip, usually with excess vertical lengthening.
At the 1973 Cleft Palate Congress in Copenhagen, William K. Lindsay of Toronto gave a late follow-up evaluation of LeMesurier's bilateral cleft lip and palate cases treated by his double quadrilateral flap. From the podium, as light reflected from his snow-white hair, Lindsay explained with a whimsical twinkle that these were mostly LeMesurier's cases, as he himself was too young for such long-term results. He reported a general grading of the appearance of the lip and nose as 18 percent good, 64 percent fair and 18 percent poor. The upper lip often revealed a side-to-side tightness, an unnatural quality and a flatness as compared to the relatively protuberant lower lip. Surprisingly, in LeMesurier's cases, he did not find the vertical length of the lip longer than normal. The noses, with typical bluntness of the tip, wideness of the alae and both shortness and width of the columella, rated less well and were the source of more complaints from the young adult patients.

LeMesurier's trick for preventing a long lip with his flaps can be deciphered in excerpts from his 1962 book:

But in some cases the lip may be made too long and may later become still longer. To avoid this excessive length, the lip, at operation, should be made shorter than the average but still within acceptable limits. This can be done by making the vertical cuts lateral to the clefts reasonably short. These cuts have to extend down far enough to make the usable parts of the flaps of sufficient length to cover the cut end of the prolabium, but the prolabium does not have to be kept particularly wide. In most cases, with extensive freeing on both sides the two lateral parts of the lip can be sutured to the cut sides of the prolabium with little tension, even if the prolabium is cut as narrow as 8 to 10 mm. With the prolabium fairly narrow, the flaps do not have to be long. . . . With the flap operation, the lip can usually be made slightly shorter than average, with no great vertical fullness of the lateral parts and no great tendency to increase later in length.

Here are photographic records kindly forwarded by Lindsay of a bilateral cleft lip operated on by A. B. LeMesurier himself at the Hospital for Sick Children, Toronto. The operation was carried out at age six months, which was later than usual. The follow-up at 13 days postoperative, then at 11 years and finally at 18½ years gives a fascinating progressive study of the result of his operation on this patient.
Of course, LeMesurier himself, unlike many others using his method, was able to avoid undue vertical lengthening of his lips by the conservative width of his lateral flaps. Yet transposition of his quadrilateral skin flaps below the prolabium not only accounts for transverse lip tightening but depletes the lip skin bank for columella lengthening and explains the flat nose and short, wide columella.

**EMPHASIS ON ALAR CORRECTION**

As in his unilateral clefts, Jean-Lucien Grignon of Hôpital Saint-Antoine, Paris, stated:

In our hands the Mirault-LeMesurier quadrilateral flap appeared particularly satisfying for the inferior part of the lip.

He then turned his attention to the persistently flaring ala. He expressed his feeling that the nasal deformity caused by the
original retroposition of the alar base attached to the cleft side of the maxilla increases with growth and gives argument for his “disinsertion” of the alar base, “hyper-rolling up” of the ala and insertion of its tip into a subcolumellar notch. Circumalar incisions free the alar bases from the lip elements. Then, as he explained,

Nasal mucoperiosteum, attached to the ala, is cut along the pyriform and lateral bone segment edge as to be rolled up with the ala.

He makes a subcolumellar incision for the advancement of the tip of the alar base and says, in clarification:

This notch, of which the depth is variable, establishes a complementary lock for the closure, receives the ala and fixes it in a suitable rolling up position.

In one primary procedure Grignon detaches the alar bases from the lip and maxilla and advances them into subcolumellar incisions. In the bilateral cleft he can achieve symmetrical and narrowed nostrils but with only minimal columella lengthening. Unfortunately, he chooses to introduce quadrilateral lateral lip flaps below the prolabium, incurring the same disadvantages of lengthening the lip vertically, tightening it horizontally and placing scars in unnatural positions.

OBUKHova

In 1955 Lidiya Obukhova of Samarkand adapted her long lateral triangular flap to bilateral clefts. After trimming the prolabium to a box square and without downward tension on it, she not only transposed two triangular flaps below it but interdigitated them! Although Obukhova’s bilateral nasal tips would not be the flattest, it is conjectured that her lips must be the longest, if not the grandest, in all of Russia.
LIMBERG

Professor Alexander Limberg, winner of the Order of Lenin, created a plastic surgery unit in Leningrad sparked with satellites of enthusiastic women including his own daughter. He was in the habit of keeping three tables working in one room, and invariably at least one held a cleft lip patient.

Probably the most artistic of this category of operations is the bilateral lip plan of Limberg. An impractical aspect of the procedure entails lengthening of the lateral lip components even though these elements are usually too long in the first place. His design ingeniously creates a Collis flap for the nasal floor and a small Mirault-Blair-Brown flap for the lip, with skin scars resembling those of Denis Browne and in fact a Browne-type exaggerated cupid's bow. Whatever else this operation achieves, the creation of an inferior pointed skin triangle in the center of the cupid's bow deserves consideration.

GEORGIADE

The most conservative modification of this general design seems to be that presented in 1970 by Georgiade of Duke University Medical Center. At least he de-epithelialized the skin he introduced below the prolabium. In principle, his modification is similar to the method described by Cronin in 1957, especially the variation accredited to his preceptee, T. A. Cresswell, which denuded the vermilion flaps and introduced them beneath a triangle of prolabium vermilion. Georgiade turns down flaps of mucosa and skin from the sides of the lateral lip elements. Yet, instead of introducing these flaps below the prolabium in toto, he
In March 1973 an article entitled "Single-Stage Repair of Bilateral Cleft Lip" was published in the *Archives of Otolaryngology*. During a quick perusal of the diagrams I could not believe my eyes and found with relief that the author was unknown to me, a C. T. Yarington, Jr., of the Department of Otolaryngology, University of Nebraska Medical Center, Omaha. My great respect for the recent Nebraska football teams caused me to reserve final judgment.

Yarington started out quite well by noting the eight rules cited by Cronin and Penoff in 1971 for bilateral clefts and then proceeded to break at least four of them. Worse, he ignored other more fundamental plastic surgery principles which Cronin would take so much for granted he would never even bother to enumerate them.

Let's study this hybrid procedure, which seems to be a frantic attempt to incorporate a little bit of everyone and ends up with a maze of irreversible scarring. The skin and mucosa of the cleft edges are trimmed as lining flaps and are sutured together in what Yarington loosely refers to as "creating gingival-labial sulcus." The misconception here is that the prolabium is still plastered to the premaxilla obliterating any true upper labial sulcus. Then lateral flaps of skin and mucosa are transposed to each other below the squared prolabium and over the turndown flap of inferior prolabium vermilion. At this point the plan is no worse than all other unfortunate methods that introduce composite flaps below the prolabium. Even his next step could pass: "The cleft on the less severely deformed side is closed in a straight line primarily." Then comes the unbelievable unilateral Z-plasty: "A
transposition of triangular flaps is applied on the more severely deformed side.”

Yarington presented one truly severe bilateral case with his results just three months later already revealing flared alae, short columella and wide prolabium with unnatural scars. It can be predicted that someone is going to be doing quite a lot of secondary surgery. The method has not created a usable upper labial sulcus, has not planned correction of the short columella, has not fashioned the prolabium as a philtrum, has not placed the scars in philtrum column positions but, most important of all, has shown complete disrespect for the coveted characteristic of symmetry which is possible even in asymmetrical bilateral clefts. Yarington’s conclusion gives his presentation a tone that I unaffectionately refer to as one of a sort of verbal “patent medicine cure-all.” It reads:

Although this type of repair utilizes a simple rotation-advancement of triangular flaps and straight-line closure incorporating many of the principles described by Millard and Yules in their reviews of various methods of repair, we believe that this presentation might be useful to those desiring a safe method of single-stage repair of the bilateral cleft lip over a mildly protruding premaxilla or in single-stage repairs following retropositioning of the premaxilla.

This is not a personal attack on C. T. Y., Jr., of Omaha as I do not know the gentleman. My tirade is included specifically for the sake of any E.N.T. men determined to close clefts who read this book and might take his design seriously. Cleft surgeons must be trained in plastic surgery principles; plastic surgery is an art unto itself but both applicable to and essential for the correction of deformities in all regions of the body.

After forwarding a copy of this critique to Yarington and requesting his rebuttal, I was encouraged by his response, as expressed in these excerpts, from Omaha:

I do not believe that it is unique for individuals to publish in medicine and find considerable criticism and opposition from others so, indeed, to later change their minds and alter their procedures. . . . I believe that your points are well taken in many instances. . . . I do agree that symmetry is of extreme importance and that the prolabium should be fashioned as a
philtrum and that the scars should be placed in a philtrum column position. In reviewing most recent cases, I find that in most instances these goals have been obtained. . . . While the procedure as described has been subject to modifications which in general bring it closer to the principles which you outlined . . . I see no reason to write a rebuttal.

NOT AN “IN” OPERATION

Methods bolstering the prolabium inferiorly with lateral flaps consisting of skin and mucosa really “scramble the egg.” The prolabium is lengthened unnecessarily and often excessively. Unnatural scars are produced against normal lines, and this damage is irreversible. The side-to-side tightness is exaggerated by the vertical length. The columella, although not drawn down quite so vigorously, is still short, deserving further lengthening. Although it can be said that methods introducing the least amount of skin with the lateral flap produced the better results, this principle should, except for rare instances, be stricken from the list of recommended procedures.
A year before I was born, George V. I. Brown had the good sense to object to the principle of sticking lateral flaps of skin and vermillion below the inferior edge of the prolabium. He noted in 1918 that incisions as advocated by Von Langenbeck, Mirault, Maas and others were undesirable:

This method of operation creates an ugly deformity by making the lip too long, and should be avoided.

At least he had the courage to speak out against methods that were popular among surgeons of his day. In spite of his early stand this principle continues to have sporadic popularity among the unenlightened even of today.

ANOTHER HEATED DISSENTER

Then in Chicago in 1951 the fiery Milton Adams of Memphis in his inimitable style pulled the pin on a grenade labeled "The Misuse of the Prolabium in the Repair of Bilateral Cleft Lip" and tossed it into the meeting of the American Association of Plastic Surgeons. The main blast of the explosion was aimed at primary surgical procedures wherein the prolabium is shifted up to build the columella and the upper lip is formed wholly or in part by suture of the lateral labial segments in the midline—or Maas, König, Rose, Thompson and Hagedorn. Unscathed were the methods of G. V. I. Brown, Vaughan, Axhausen and Warren Davis, wherein the prolabium alone is utilized for the total vertical lip. This presentation, co-authored by the Adams brothers
Milton and Lorenzo from Tennessee, was published in 1953 and became a classic.

Milton Adams admitted that 14 years earlier he had first shifted an infant’s prolabium into the columella to avoid the flat-tipped nose and had closed the lip side to side beneath it. The Memphis fireball blamed being tempted into this trap on his happier experiences with the same principle in adult cases.

True to his mottoes “It is often as necessary to know what not to do as to know what to do” and “A good surgeon should always be his own severest critic,” Milton pointed out his findings:

It is difficult to explain why the upper lip of an adult repaired by suture of the lateral segments together in the midline will remain as constructed while in an infant it will be followed by practically twice the normal lengthening of the lip.

The Adams boys conjectured:

Perhaps, the extra length in the infant is developed by repeated drawing of the lip down over the premaxilla, whereas in the adult, the teeth support the lip.

They admitted:

The prolabium is often small, even rudimentary and one may thus be tempted.

But they hastened to reassure:

Indeed, the development which takes place in even a rudimentary prolabium is amazing.

They advised staging the repair rather than sectioning the vomer and advocated correction of the nasal deformity after the child acquired an adult facies.

In 1973, more than 20 years later, Lorenzo Adams reconfirmed their previous stand:

It is my impression now that the information in the article presented by Milton and me on the misuse of the prolabium in repair of double cleft lip in infancy is valid. It is now my impression that in cases of double cleft lip and palate after attaining maturity of the facial features in postadolescence, flaps from the lateral segments may be utilized above or beneath the
prolabium without resulting in excessive elongation in the vertical dimension of the lip. This is in contrast to the results of the same procedures in infancy.

**A CHECK**

Whether this 1951 Adams stand started a trend or put a brake on previous trends, it brought to the fore what many surgeons were beginning to realize. Here is an example. In 1954–1955 while I was at “A Med” with the First U.S. Marine Division, Korea, Sten Stenstrom of Sweden was down at the Swedish Hospital in Pusan. During his time there, he used the LeMesurier quadrilateral flap to introduce skin and mucosal tissue beneath the prolabium on 18 Oriental bilateral cleft cases. He stated in his 1957 preliminary report:

Only by long observation can the procedure be fully evaluated.

Whereupon Bromley Freeman of Houston, Texas, responded in 1958:

About seven years ago, I tried this combined LeMesurier technique on a small number of patients for bilateral lip repair and have been able to follow them a little longer than Dr. Stenstrom. I have found that the lip grows entirely too long, as typical of the older methods of repair. . . . While I was doing a secondary repair, it occurred to me that I should bring this to your attention, so that the younger men could be apprised of the fact. . . . In informal discussion with several of my colleagues I find that they have met with similar difficulty.

**A MASTER’S SECOND THOUGHTS**

LeMesurier had adapted his modification of Hagedorn for the treatment of bilateral lip clefts and was sliding two quadrilateral flaps along the lower border of the prolabium. He began to realize from follow-up observation that when the prolabium was long primarily, his approach could only produce longer upper lips. Thus, in his 1962 book, he outlined his selective plan:

If the prolabium is long enough to make the central part of the lip of decent length and if there is enough mucous membrane available to make the vermilion border thick enough, it is probably better to bring the prolabium
down and use its lower edge to form the central part of the lower border. . . . In bilateral cases in which the prolabium is too short to make the central part of the lip sufficiently long, or if its mucous membrane is extremely thin, it is better to turn down flaps from both sides and suture them together in the midline below the prolabium.

Then he charted the design for each general category of bilateral lip clefts and included an alternative approach incorporating the whole length of the prolabium as the central component of the lip.

Complete bilateral clefts

LeMesurier

His alternate

LeMesurier in typical candor stated:

It must be admitted that no matter which operation is done, the results obtained in the complete bilateral cleft of the lip are always far from perfect.

One complete cleft, one incomplete

LeMesurier

His alternate

Both clefts incomplete

LeMesurier

His alternate
LeMesurier’s comment on his results of incomplete type of bilateral clefts was:

No matter which operation is done, the results are usually better than in the other types of bilateral hare-lips.

A SALTY CRITICISM

In 1972 Broadbent and Woolf of Salt Lake City evaluated the use of the LeMesurier method in bilateral clefts and reported unimpressive results whether done in one or two stages, disappointingly long lips, a false and irregular cupid’s bow, a prolabium still adherent to the premaxilla, a whistling deformity and a flat nose. The length of the two sides of the lip were often unequal, and at times, the scar pattern resembled a sketch of a Christmas tree more than a normal philtral ridge.

OBJECTIONS FROM TEXAS

Tom Cronin of Houston, Texas, joined the Adams swing in 1957 and retold the story:

Adams and Adams, at one time, used all of the prolabium in the initial repair for lengthening the columella, but they found that within a year, such lips were becoming entirely too long vertically and that this tendency continued with the growth of the child. They now strongly advise against this procedure and I agree with them completely.

In reference to previous methods which turned flaps of skin from the lateral lip elements beneath the prolabium to increase its vertical length, Cronin explained:

This practice has obviously arisen because the prolabium appears to be shorter than the lip fragments on each side. All prolabia, in their isolated position, appear smaller than their actual potential when incorporated in the lip. In the first place, the prolabium actually is thinner than the lateral lip tissue and, secondly, as there are no attachments to stretch the prolabium out, it shrinks down to the smallest area possible.

Cronin went on to describe his premaxillary setback and a rather simple bilateral lip closure in one stage with the prolabium used
to form the full vertical length of the middle of the lip. This procedure of course left the columella short and the nasal tip depressed and merely set the lip groundwork for his later columella lengthening.

By 1971 Cronin was even more decisive against inferior skin bolstering and even lateral interdigitations of the prolabium. With Penoff, he fired some broadside shots:

The Veau II. or Barsky type operation is an obsolete procedure resulting in a lip which is too long vertically and too short from side to side. The tightness contributes to retraction and lingual tilting of the incisor teeth. . . . The Barrett Brown procedure removes all of the prolabium vermilion bringing the vermilion of the lateral segments together in the midline, thereby tending to constrict the prolabial skin in a circular manner, as well as making the lip a bit tight from side to side. . . . Only one adaptation of the LeMesurier operation was done. This procedure was wasteful of tissue, tended to result in side to side tightness and noticeable scars.

THE HORIZONTAL VERSUS VERTICAL LIP GROWTH OBJECTION

Ernest N. Kaplan of Stanford Medical Center has measured horizontal length of unilateral clefts in the newborn and the adult and found that the lip length doubles its original horizontal dimension (100 percent). Similar measurements of vertical philtrum height in the newborn and the adult indicated a proportional growth of the prolabium, with only 50 to 75 percent vertical growth potential from the newborn to the adult. He noted in 1974:

When the 50-75% vertical growth is compared to the 75-100% horizontal growth, we can appreciate that a cleft lip can grow twice as much in the horizontal direction as it can in the vertical direction. Therefore, any operative procedure taking tissue that is horizontally arranged and transferring it in the vertical direction must account for this potential growth differential. This, we believe, explains why the Asensio and the LeMesurier repair can grow too much on the cleft side when the procedure is performed in a newborn, but little or no discrepancy is seen when the procedure is applied to young children and adults.
A CAUSE OF INCREASED VERTICAL LIP LENGTH

Although Kaplan’s studies have been confined to the unilateral cleft, of course they also apply to the bilateral cleft, and doubly so. Thus, any vertical flaps transposed horizontally, as so often noted, usually will be responsible for abnormal increase in vertical lip length; this is another sound contraindication to the use of such flaps.

In spite of these wise warnings by experienced surgeons for over half a century, operations are still being done in which lateral flaps are introduced below the prolabium. The invariably unacceptable results being seen in many cleft clinics and the severe difficulties encountered during their secondary correction warrant stamping these actions OBSOLETE and DANGEROUS and having their use outlawed.
10. Interdigitations into the Sides of the Prolabium

Following close upon the quadrilateral flap of Hagedorn, modernized by LeMesurier for unilateral clefts, had come the inferior triangular flap of the Tennison Z-plasty. The improvement in the cleft lip evolution had been a step from creating an artificial cupid's bow to preserving what bow was already present. In the prolabium of bilateral clefts there is no residual cupid's bow, so the surgeon is back in the position of trying to find the best way to construct one. The LeMesurier method, already established as a cupid's bow maker, probably had the edge over the Z method, which depended on nature's residual bow. Yet the purchase of a bow with quadrilateral flaps below the prolabium was not worth the price of the scars and a long lip.

Although I never heard directly that Tennison applied his inferior Z-plasty to bilateral clefts, it is quite possible he did so. Certainly other surgeons, infatuated with the Z in unilateral clefts, reveled in the chance to double it against the poor prolabium. Fortunately this principle did not add flaps below the prolabium but merely interdigitated flaps into its gaping sides and did not tend to cause vertical lengthening of the central segment. Rather it produced an odd pair of zigzags unreproduced anywhere in nature. Take, for instance, Skoog's design, which, while interdigitating medial flaps across the base of the columella, interdigitates lateral flaps in the spirit of Tennison into the sides of the prolabium. Maisels and Littlewood of Liverpool at the Rome Congress in 1967 commented on Skoog's approach:
Not only is the columella lengthening achieved by this method somewhat limited, but also it seems desirable to repair both sides at the same operation.

Bauer, Trusler and Tondra of Indiana stated in 1971:

We consider that lengthening the lateral borders of the prolabium by the Z-plasty type of closure has produced scars that are less noticeable than the straight-line scars. Also, the increased length in this area has produced more normal contour to the vermilion border.

Then Kolesov endorsed the Indiana interdigitations with slight modifications for his Russian rendition.

Yet their arguments for this line of union seem quite illogical. A zigzag scar runs against natural skin lines, and lengthening the sides of the prolabium and leaving the center short explains the common occurrence for them of a central notch (whistling deformity) requiring secondary surgery.

A probe into China by Gaston Schwarz of Montreal in 1974 was answered by a plastic surgeon in the Peking Medical College:

Since 1963, we have been using . . . the Tennison principle for bilateral harelip.

Several of the world's best cleft lip surgeons had a go with this approach but eventually became disenchanted.

**GOOD INTENTIONS**

The Allentown team of Marcks, Trevaskis and Payne in 1957 proposed a campaign: “Be Kind to the Prolabium,” suggesting preservation of the prolabium in its entirety, including the skin vermilion ridge, and not prescribing introduction of skin inferior to its lower border in the hope that the scarred and distorted prolabium would ultimately be a thing of the past. At least they realized that the length or width of the prolabium was no factor whatsoever as it will increase in size in all dimensions. In their opinion its eventual hair ruled it undesirable for the columella. They presented possible designs, one of which was a Tennison-type approach adapted to bilateral clefts with radical interdigitations.
As this adhered less to their campaign slogan with more violation of the prolabium, in the end it found less favor with them than their other more conservative design.

AN IMPROVEMENT ONLY

In 1972 Broadbent and Woolf with Mormon honesty evaluated their application of the Tennison design to both sides of bilateral clefts. They reported:

It preserved a more normal vermilion ridge; gave consistently better length to the lip, and saved bilateral triangles of tissue medial to the peaks of the cupid’s bow—including the vermilion ridge on the central prolabium. The latter avoided much of the horizontal tightness and resulting flatness of the lip. . . . Still existing were an adherent prolabium, a flat nose with flaring nostrils, some inequality in lip length and persistent irregularities in the vermilion ridge and mucosa. The Christmas tree lip scar now looked as though it had a two-legged stand under it, carefully encircling a small diamond of prolabium mucosa in the area of the central tubercle. A whistling deformity and a flat central lip often resulted.

Here is a similar example of the same method performed in a great eastern seaboard center bearing the trademark that was described by Broadbent and Woolf.
And another, except that this Christmas tree scar had its top chopped off by the transverse nasal base incision used in the Carter-Cronin columella-lengthening procedure. The narrowing of the alar bases during the partial columella lengthening presents pig's-ears in the lip below the alar bases. These mounds plus the lateral muscle bulges and the lateral flap interdigitations into the sides of the prolabium accentuate the absence of muscle in the prolabium.

It was easy to see that Cronin's final evaluation of the inferior triangular flap in bilateral clefts came painfully to him:

Adaptation of the Tennison type incisions to the bilateral lip has produced some very nice results for me. It tends to give a nice protrusion to the central vermilion. The scars, however, seem to be more noticeable than when the procedure is applied to the single cleft lip. If revision is necessary, it may be a little more difficult than a straight line repair.

There are other modifications of the interdigitations into the sides of the prolabium as that of Orticcohea which not only make no effort to imitate philtrum columns but present a maze of irreversible scars.

THE Z IS OUT

The original advantage of preserving a portion of the cupid's bow with a Tennison Z is not valid in bilateral lip clefts. The natural
lines of the philtrum do not zigzag transversely back and forth across Langer's lines. Lengthening the sides of the prolabium offers no true advantage except to break the contracture of the so-called straight-line scar. Yet the advancement of mucosa and muscle past the skin closure posteriorly and the mucosa inferiorly, as in the method I propose, achieves a Z-plasty of layers in hidden planes leaving only the skin apposition as a curving line. On its own, the skin will show minimal threat of contracture, if any. Thus, it is far better to resist the temptation to "scramble the egg" by interdigitating skin flaps into the central sides of the prolabium just for the thrill of executing a familiar Z technique. Rather, let the sides of the prolabium come together with those of the lateral lip elements naturally in the general line of philtrum columns. Revisions and columella construction will be much easier.
11. Joining Portions of the Lateral Elements Behind the Prolabium

There has been a school of sporadic surgeons who, although they agreed that the prolabium should form the entire vertical skin length of the central portion of the upper lip, called upon some portion of the lateral lip elements to back the prolabium. A German named H. Meyer was first. In 1929 he freed the prolabium from the premaxilla, turned vermilion flaps back from the cleft edges of the lateral lip elements and advanced and sutured them together posterior to the prolabium.

Joining the Muscles

Louis W. Schultz, Professor of Plastic Surgery, Children’s Memorial Hospital, Chicago, was a pioneer in bilateral cleft lips. Although the general plan had been described almost 20 years before by Meyer, Schultz added the retention sutures to approximate the muscle across the cleft. As he stated in 1946:

Not being satisfied with the results obtained in most bilateral cleft lip operations performed by various operators including myself, the author searched diligently for a method which would produce a more nearly perfect effect.

As he explained, an important prerequisite to success is the understanding that

all the normal parts are there. All you have to do is unite them.
In a patient one month old, Schultz retroplaced the premaxilla by V section of the septum and, after denuding the opposing cleft edges of the maxillary and premaxillary segments, approximated them with 4-0 nylon sutures to get what he referred to as "bony union." One month later he achieved a one-stage closure of the lip by elevating the prolabium from the premaxilla and turning flaps of skin and mucosa from the lateral lip elements to be sutured together behind the prolabium in the midline. He placed retention-type sutures across from muscle to muscle and then set the prolabium into the defect so that it formed the skin and vermilion of the central external portion of the upper lip.

This approach emphasized an important principle and subsequently was responsible for influencing the surgical treatment of bilateral clefts. In the cases presented by Schultz, however, there were two glaring discrepancies: the unnatural look of the prolabium vermilion and the persistent shortness of the columella.

The Australian pediatric surgeon Denis Browne of the Hospital for Sick Children, Great Ormond Street, London, in 1949 redescribed his method of bilateral cleft lip closure. This eccentric surgeon chose a 2 mm. ophthalmic trephine and a half-inch chisel to punch and carve the infant's lip against a slip of soft wood more the way a leather cutter would than a plastic surgeon. His design discarded much tissue but shaped the prolabium to a point and used it to construct the entire central vertical skin segment of the lip, adding only the lateral mucosal flaps to the inferior border of the prolabium.
To this orthopedic-oriented surgeon the most important part of the operation was the muscle closure, which he described:

The joining of the muscles is done by deep vertical mattress sutures of 000 chromic catgut, inserted so as to bring together the whole thickness of the lateral portions with the exception of the already sutured skin. The first of these is put in opposite the trephine holes, and two others usually are enough to join the entire undersurface of the lip. The effect of these sutures is triple: to join the muscles, to join the mucosa, and to make the lip pout. There is no need to dissect the muscles free and suture them as a separate layer. One knows exactly where they are, and the less they are injured the better.

Donald M. Glover, general, pediatric and plastic surgeon at Case Western Reserve University, Cleveland, gained his early interest and training in clefts under William Ladd at Boston Children's Hospital. With the same tenacity that won him the U.S. Army's Legion of Merit, Pacific Theater, in World War II, Glover has clung to the principle of joining the lateral lip musculature across the clefts in front of the floating premaxilla. In 1961, with M. R. Newcomb, he first published his stand. From his Adirondack hideaway island in Seventh Lake he wrote his unchanged 1974 views on bilateral lip clefts:

Close the lip in front of the premaxilla. This is almost always possible in one stage; only about one in ten requires secondary closure. The functioning lip, with orbicularis united behind the prolabium and in front of the premaxilla, provides the best restraint upon the premaxilla. To force it backward or reposition it by sectioning the vomer affects the growth of the premaxilla by interfering with its blood supply. The lateral maxillary processes should be allowed to grow forward and meet the premaxilla. There may never be complete union and early appearance may not be ideal but later orthodontia will make up the deficit.
The technique of the lip closure is not too critical, but the simple methods we have described removes the mucosa from the prolabium, preserving the vermilion border, and uniting the orbicularis and the mucosa from the two sides in front of the premaxilla. If the orbicularis repair does not hold (about one in ten) it should be re-united after several weeks. . . . These conclusions are based upon follow-up from five to fifty years.

This use of the entire prolabium in the central vertical length of the lip does not provide for the inevitable columella lengthening. Maintaining a triangle of prolabium vermilion with color and texture not identical to the lateral vermilion tends to set it apart rather than blend it into the lip red. In spite of these details it must be recognized that pioneers in uniting muscles across “no-muscle-land” were responsible for a major step in the progress of bilateral cleft surgery. Even today there are surgeons who do not appreciate or incorporate this fundamental principle.

For instance, Fara of Prague, who has made such a precise histological stand for getting the orbicularis oris muscle fibers in unilateral clefts lined up and joined end-on in a horizontal direction, strangely takes a rather loose position in bilateral clefts. In 1967 he and Smahel reported sections taken from the prolabium and lateral lip segments through a posterior horizontal excision after surgery and summarized:

In the first weeks or months after the suture of the lip, there is marked regeneration and proliferation of the muscular fibers into the tissue of the original prolabium. Later on, the major part of these fibers is gradually replaced by connective tissue. But some muscular fibers always remain in the tissue of the central segment, which, together with the collagenous fibers newly formed chiefly along the longitudinal axis of the lip, make a suitable connecting link between the two ends of the musculus orbicularis oris.

Thus, they are saying that after simple, direct suture of the lateral lip segments to the central prolabium there is a heroic fight of the lateral muscular fibers, frustrated embryologically by the clefts, to accomplish a delayed invasion of the prolabium. Then after establishing a substantial “beachhead,” the muscle fibers tire and retreat, leaving only a few stragglers to hold the line:
This reconstitution of the circle of the sphincter oris which is functionally suitable plays a valuable part in the linking of the prolabium to the reconstructed lip.

It seems ridiculous to me not to help the struggling lateral muscle fibers across the "no-muscle-land" of prolabium so that they join each other. It is easy, has been done by many surgeons and means advancing each side only a few millimeters farther.

MORE MUCOSA AND LESS MUSCLE

The Indianapolis team of Trusler, Bauer and Tondra has closed a lot of bilateral clefts. In 1955 they described a two-stage procedure in which one lateral cleft edge was turned as a flap of skin and mucosa to be introduced behind half of the prolabium after it had been freed from the premaxilla.

The opposite side was done in the second stage in similar fashion, creating a labial sulcus.

The bombastic Harold M. Trusler, senior surgeon and motor force of this Indiana unit for years, had been using Barrett Brown's premaxillary retroplacement followed by the Brown-McDowell bilateral triangular flap lip closure in one stage. He began to find the late results disappointing since in Indianapolis,
at least, the vertical length of the lip became too long and the horizontal length too short. Many lips had to be shortened at the time of columella lift and an Abbe flap inserted for relief in the side-to-side tightness. Insufficient thickness of vermilion in the center was producing what he referred to as the “whistle deformity.”

True to his motto “Progress is our most important product,” Trusler was willing to reevaluate bilateral cleft surgery. The first change that he, Bauer and Tondra made was in avoiding premaxillary retroplacement, which resulted in improved face development but because of extra tension ended up with wound disruption or, at best, poor scars. Finally, in 1959 Bauer, Trusler and Tondra adapted their 1955 bilateral design, which was a modification of a design they had described for unilateral clefts in 1953. The first side was closed at two weeks of age with a small triangular flap from the lateral side of the cleft fashioned to fit into a notch incised into the prolabium. Half of the prolabium was freed from the premaxilla, and the mucous membrane flap from the lateral side carrying a small amount of muscle fibers was brought beneath the prolabium.

Two months later, the second side was done, creating a moderate upper labial sulcus and part of a muscle sling.

In 1965 in Bratislava, Professor Stefan Demjen of Comenius University invited John Tondra to demonstrate the Indiana procedure for bilateral clefts. We witnessed his precise execution of a one-sided closure of a bilateral cleft demonstrating the introduction of the lateral flap behind half of the prolabium.

Finally, in 1971, in *Cleft Lip and Palate*, edited by Grabb, Rosenstein and Bzoch, the team of Bauer, Trusler and Tondra discussed their results as “encouraging,” with more normal face growth, normal upper lip length with eversion, good balance, a good labial sulcus and no need “for an Abbe lip-switch procedure.” They noted several problems including a common notching of the central vermilion requiring secondary muscle plication and the tendency to dryness of the prolabium vermilion. Then there was the lack of nasal tip development:

However, in most cases this development is not sufficient to obviate the necessity for some type of columellar-lengthening procedure.

In the Division of Pediatric Stomatology of the Moscow Medical-Stomatological Institute, A. A. Kolesov has developed a method which combines several principles. In 1970 he described this two-stage closure with the skin incisions similar to those of Tennison, Limberg and Obukhova and the vestibular sulcus created in the manner of Bauer, Trusler and Tondra. Kolesov described dissecting the prolabium from the premaxilla with particular attention to freeing the columella to the tip of the nose. The Tennison-type incision along the side of the prolabium freed a lateral mucosal flap, which was either excised or folded to cover the raw premaxilla. The lateral lip element was incised into flaps in the style of Limberg, Obukhova and Tennison with a portion for the nostril floor and a turnover flap of mucosa and skin as used by Bauer, Trusler and Tondra to line the backside of the undermined prolabium.

![Diagram: Surgical technique for prolabium closure](image-url)
Kolesov operates on the first side very early and the second side two months later.

LATERAL MUCOSAL FLAPS BEHIND THE PROLABIUM

Clayton R. DeHaan of St. Luke's Hospital, New York City, prefers to close bilateral clefts in one stage and demonstrates ingenuity in creating an upper labial sulcus. He described with illustrations the details in his section of Stark's 1968 book:
The two-stage operation is less satisfactory, in our opinion, for several reasons. . . . When one side only is corrected, the premaxilla rotates toward it, widening the cleft on the other side and twisting the prolabium; thus the second side is technically more difficult to correct. . . . We prefer a straight linear repair of both sides of the lip in a single stage. . . . Prolabium vermilion surfaces the premaxillary side of a deepened alveolabial sulcus, while vermilion from the lateral lip elements is advanced to the midline beneath the prolabium.

DeHaan notes that the definite landmarks present in unilateral clefts are lacking and warns:

All points on which the repair is based depend upon the surgeon's judgment and experience. A small prolabium makes the correction relatively more difficult but it may still form the entire central lip since under tension the growth potential of this tissue is phenomenal.

He is, alas, willing to reenter the lip for columella lengthening:

The prolabial segment is often too wide following repair and lacks the desired normal appearing philtral ridge with dimple. No attempt should be made to narrow it at this time, as this segment will later furnish ample tissue for lengthening the columella.

**A VARIATION IN TWO STAGES**

The indefatigable Charles Horton, with Adamson, Mladick, and Taddeo of Norfolk, in 1970 advocated preservation of vermilion parings for covering the raw surface of the premaxilla. Then in 1974 Richard Mladick, with Horton, Adamson and Carraway, reproposed this principle along with introduction of lateral mucosal flaps behind half of the prolabium in a two-stage primary procedure. This achieves lining for both sides of the labial sulcus and frees the prolabium from the premaxilla.
The droll and wiry William M. Manchester of Middlemore Hospital, Auckland, New Zealand, has developed his own modification of a "down-under" approach to bilateral clefts. He refers to himself as "a rather 'square' sort of a person," but this description is not upheld by the facts. He has been active in postgraduate surgical education, has achieved renown from his stories about the exploits of the New Zealand All Blacks Football Team and is building a country house in a natural New Zealand forest filled with native plants and birds. As he recalled sympathetically,

I remember Sir Harold Gillies once telling me that what he yearned for most in England was the smell of wet New Zealand bush.

His analysis of his own philosophy gives the truest picture of Bill:

I am not a rebel but I am a great believer in people getting on with their job without unreasonable complaint, conscientiously and without too much thought of "what's in it for me." In other words the job being an end in itself.

In 1970 and again at the Melbourne Congress in 1971 Manchester described his approach to bilateral clefts, an approach which limits the amount of lateral lip elements introduced behind the prolabium as the prolabium is not freed from the premaxilla and the lateral muscles are not joined together. After lateral manipulation of the maxillary segments by his orthodontist, he accomplishes closure of both lip clefts and hard palate in one operation. He trims the lateral vermilion of the prolabium as a pair of flaps based inferiorly on the mid-vermilion, which swing out like wings A and B "à la Axhausen."
Then he unrolls the inferior vermilion of the prolabium trapdoor fashion so that the entire prolabial component unfurls. The wing portions, which come from the lateral sides of the prolabium, are denuded of epithelium and fold onto each other under the central vermilion to give more body to the mid-tubercle area. Manchester leaves the prolabium attached to the pre-maxilla but advances the turnover mucosal flaps X and Y from the lateral elements “down-under” his central unrolled vermilion flap.

The lateral lip elements are joined in a straight line to the sides of the prolabium with the scar of union ending bilaterally in the nasal floor.

These actions provide extra mucosa to the central tubercle but do not free the prolabium, line it or bring the lateral orbicularis oris muscle fibers together behind the prolabium. This approach produces a good lip but results in a wide prolabial component with an ample but stuck-on looking central vermilion segment. The nose shows some alar flaring and a short columella with the usual depression of the nasal tip.
Manchester discounted any concern for the short columella, wide prolabium and broad cupid’s bow, advising correction of the one with the other by a forked flap when the patient reached 16 years of age. Apparently he had no hesitancy in reentering his lovely lip to cut out a forked flap.

Evaluation of these shortcomings, stimulation by modifications of his method in the literature and weariness with wrestling with the secondary surgery probably led Manchester to change his plan slightly. In August 1973 he cited this case 11 months
postoperatively as representing the procedure at its present state of development.

He pointed out:

You will note that the prolabial part of the lip is narrower in her case as I am no longer preserving material for use in elongating the columella later. I no longer believe that this is the right way to lengthen the columella and we are developing other methods at present.

When challenged further he wrote back in September 1973:

I have fairly strong views about the nasal tip, for example, the timing of the repair and the method of doing so. . . . I happen to believe that the junction between the columella and the upper lip is about the only normal part of the nose and that this part of it should remain inviolate. Even in the best of hands, this part looks unattractive and to me is a real disfigurement . . . and I am concerned that infancy is not the best time to do it for a whole variety of reasons.

This is an interesting shift of focus, but there is no great problem to getting a fine final nose in adult bilateral clefts. It is the years of suffering with the flat nose during childhood that cannot continue to be ignored.

Then in November 1973 Manchester sent another nice lip but
still with wide alae, short columella, wider than normal philtrum, straight-line scars but full tubercle.

IMPROVING THE SCAR LINE

T. Ray Broadbent of Salt Lake City is a giant among plastic surgeons not only in height, offices held and contributions but also in his philosophy:

We are common children of a Father in Heaven who looks at the worth of an individual soul as being of more value than anything else.

When not engrossed in his first hobby—work—he enjoys going up in the mountains and doing a little farming and working with horses, including breaking in colts to ride. Fascinated with the challenge of bilateral clefts, concerned about the lack of an upper sulcus and the tendency for a whistling deformity, and disenchanted with the Christmas tree effect of the bilateral Z, he turned to the method of Manchester. It was not long before he was modifying Manchester’s wide prolabium and straight scars with what he loosely called “a Millard scar pattern” along the rotation-advancement line with circumalar extensions and reduction of the prolabium. Broadbent and Woolf reported their results in 1972 with this modified Manchester approach, claiming a lip with satisfactory length, a cupid’s bow, a full central tubercle, an acceptable scar pattern, a free prolabium and an adequate superior labial sulcus.

Indeed they presented lovely photographic results of the lip at least at rest, and there was no question that when they used the
rotation-advancement scar line the effect was more natural. This is particularly well exemplified in one of the cases published in Plastic and Reconstructive Surgery in July 1972 which had a rare dimple in the prolabium and a longer than usual columella in the original deformity.

Late in 1973, upon request, Broadbent forwarded, besides the above case, some examples of his bilateral clefts, stating:

You may use any or all of these as you see fit. They will demonstrate two or three points that I would like to make:

1) The best scar . . . is the first one . . .
2) The prolabium should always be narrowed to be no longer than
6 mm. from peak to peak or three from the center to each peak of the bow. Otherwise the bow is too wide and the lip does not look normal.

3) . . . The sketch that is enclosed, though the lines do not match in length, show in dotted line a wide prolabium saving everything and in the solid lines the narrowed prolabium as we would do it. Further I think the line should be curved and tucked closely to the base of the columella to keep the incision and scar out of the floor of the nose. The scar on the floor always looks like a dirty, runny nose.

**A MEXICAN MANCHESTER**

Another variation of the Manchester theme was described in *Plastic and Reconstructive Surgery* in 1973 by Micheline Viale-Gonzalez, Felipe Barreto and Fernando Ortiz-Monasterio of the Graduate Division of the School of Medicine of the Universidad Nacional Autonoma de México.

The senior author of this modification is a Franco-Italian lady with *joie de vivre* who began her study of medicine when her daughter started school. Thus she is prompted to say:

I am a middle aged doctor with all the anguish and ambitions of a very young one. . . . I don’t "enjoy" bilateral clefts, I only react to the challenge. They are difficult, so, I like them.

In their design these authors first unroll a V of posterior-inferior prolabium mucosa (C) in the spirit of Manchester. Cutting the lateral mucosa free from the sides of the prolabium but leaving it attached to the premaxilla forms two flaps, A’ B’ C, which are sutured to each other over the front raw area of the premaxilla and then are folded back on themselves to form lining to the prolabium and a partial labial sulcus.

The sides of these flaps are sutured to the mucosa of the lateral lip elements. The only muscle approximated is that in the lateral
vermilion flaps, which are sutured together below the prolabium just behind the inferior central V of prolabium vermilion to form an exaggerated tubercle.

This action provoked the authors' claim that "the whistling deformity belongs to the past." Yet here again a lot of fancy maneuvering has taken place without provisions for lengthening the persistently short columella. Violation of the original lip scars is justified with:

Although we agree with Millard and Broadbent that the best scar is the first one, we feel that secondary elongation of the columella is imperative in most of these patients—and a good secondary scar can be obtained with careful technique. . . . Preservation of all the prolabium skin makes elongation of the columella relatively easy by the forked flap technique, several months after closure of the lip.

BOLSTERING THE CENTRAL VERMILION

A variation in the principle of introducing the lateral segments behind the prolabium was devised in 1963 by Brazilian Victor Spina, a strong man of São Paulo. He seems less concerned with muscle continuity across the clefts than with bolstering the prolabium vermilion to avoid a whistling deformity. In 1966 he readvocated his approach in three stages. The first two operations, two to three months apart and completed by one year, merely transformed bilateral complete into bilateral incomplete clefts.
Then, at five to seven years of age, the closure is reopened but with maximum preservation of the lateral vermilion, which is de-epithelialized. As a matador might tuck two swords under his cape before the kill, Spina slides denuded lateral vermilion flaps side by side under the prolabium vermilion. The lateral lip elements are reattached to the sides of the prolabium.

Staging the procedure means that more operations are required and more tissue is discarded. And, in spite of all this effort, there is still the problem of the short columella and depressed nasal tip—and less tissue available now to deal with it.

In 1970 José Guerrero-Santos and Marcos Ramirez described a procedure denuding the lateral paring flap and introducing it across the cleft to bolster the prolabium tubercle. At this time they interrupted the vertical closure with a type of Tennison interdigititation and treated one side at a time.
In 1973 Guerrero-Santos wrote from Guadalajara that several years earlier he had changed to the rotation-advancement method and combined his denuded lateral flaps buried behind the prolabium vermilion.

BACK ACROSS THE BORDER

A type of bolstering of the central vermilion by lateral elements was conceived early by Thomas A. Cresswell while in Texas. Cronin, in his 1957 double cleft paper in Plastic and Reconstructive Surgery, included a diagram of Cresswell’s modification which denuded the vermilion of flaps X and Z for introduction beneath the “lift up” triangle of prolabium vermilion Y. Cresswell recalls,

When I was with Tom Cronin back in 1956, Tom was interested in reviewing his cases of bilateral cleft lip repair. As his preceptor, it became a part of my assignment to assist with this review. It did not take much of a discerning eye to note that all of these bilateral cleft repairs, despite Tom’s admitted technical skill, had one thing in common, namely, that the central portion of the free margin of the lip was notched, due to a lack of substance in this central portion of the vermilion. . . . At that time I suggested the procedure Tom credited me with.

A LITTLE OF BOTH

Remembering that Cresswell had shown this ability to fly on his own in bilateral clefts, I was inquisitive as to where his flights
had carried him in the 16 years since he flew from the Cronin-Brauer nest.

He was trailed to Saginaw, Michigan, and the "game" proved worth the tracking. He wrote me his unpublished thoughts in August 1973:

My subsequent reading about the lack of any form of musculature in the prolabium itself, as evidenced by electromyographic studies, coupled with the reading of information concerning the deployment of the muscle fibers in the lateral lip masses, started me thinking. As I recall, these fibers come transversely across the lip margin and extend upward to the area of the alar bases on either side, curling somewhat in this area. After seeing this particular illustration in a text which I have now long since forgotten, it occurred to me that a logical procedure would be to actually go up and cut into this lateral mass at the root and take down a rather long segment of heavy muscle fibre on each side and bring this across the mid-line under the elevated portion of the prolabium vermilion and attach it to its opposite member, overlapping them slightly to provide not only continuous musculature across the upper lip margin, but to add some fullness to this central part of the lip. . . . I have followed this procedure now for quite a number of years and have a series of cases.

A GOOD LIP

The general plan of uniting the mucosa from the lateral lip segments behind the prolabium offers several advantages. When
the tension of the closure is taken in the hidden posterior scars, the skin scars are usually superior in quality. The prolabium backed by mucosa also has a natural sulcus. This leaves an inanimate, somewhat flattened prolabium. When the muscles of the lateral elements also are joined to each other behind the prolabium, all the previous advantages are enjoyed, possibly to even a greater degree. In addition, the upper lip becomes an animated, functioning unit that can mold the premaxillary-maxillary arch effectively and will not let the central prolabium stretch out flat like saltwater taffy. Full-length vertical joining of both mucosa and muscle, it would seem, offers a sounder lip construction than is obtainable with strips of muscle or flaps of the subcutaneous tissue. There is, however, one side-effect that is a disadvantage in reverse. The columella is still short, but with the lip so soundly constructed its refusal to stretch reduces the amount of tissue available for a secondary forked flap. If a forked flap has not been banked, it must be taken out of the lip, and the resultant scars will usually be of inferior quality when compared to those following the original lip closure.

**COLUMELLA FROM NASAL FLOORS**

When the lip has been well formed, with muscle continuity from side to side and without flat unnatural spreading of the prolabium, one will have difficulty taking a flap or pair of flaps out of it. It is then that tissue from elsewhere may be of value. The medial and upward rotation of skin from the nasal floors in continuity with the alar bases can shift a limited amount of tissue into the columella. This principle was first described by Carter but perfected and popularized by Cronin. It has the advantage of not reentering the lip for nasal revision, but its effect in the severely depressed nasal tip is less than dramatic.
12. Personal Experience and Gradual Evolution

A severe bilateral cleft of the lip and palate in a newborn with a protruding premaxilla and a small blob of probium sitting out in front of the opened-out nose is indeed a horrifying sight. It transforms a baby into a monster. The shock, anguish and fear suffered by the parents are enough to inspire surgeons to transcend their greatest effort. Yet so many factors are involved and so complicated is the problem that as a student I considered it a triumph just to get the cleft closed. This was the standard approach at Boston’s Children’s Hospital in the 40’s and later with Beverly Douglas at Vanderbilt University Hospital, Nashville. By the time I began to study with Sir Harold Gillies, I had seen enough bilateral postoperative results with the nasal tip dragged into the lip to begin to take sides with the nose. The very spirit of Gillies’ clinics stimulated controversy, and, except for fundamental principles, no accepted standard was considered sacred. When Bill Holdsworth let me come on to his cleft lip and palate service, for several months in 1949, I was allowed to do whichever clefts were admitted during that time.

Among other cases, I was guided through a straight-line closure in two stages of a bilateral cleft lip with a protruding premaxilla. The resultant flat nose haunted me even more than the others because I had been directly responsible for it.
When another bilateral lip was admitted, I asked Holdsworth's permission to approach the closure differently. Bill was a good teacher with an easy way about him and he listened to my plan and gave his blessing. I trimmed the vermilion mucosa off the prolabium, shifted it up toward the columella so that there was no pull on the nasal tip and brought the lateral lip elements together beneath it. I remember at the time being surprised at the ease of lip closure but had contemplated the possibility of a small midline Abbe flap for a philtrum later. In 1951 Holdsworth showed the case in his book with a short-term follow-up and this comment:

If the lateral elements of lip be joined in the midline, and the prolabium is set into the columella, depression of the nasal tip can be avoided, but there is a tendency for the lip to be tight and high.

I had occasion to see the little girl five years after my primary operation, and at that point a Gillies cupid's bow procedure was used in an attempt to improve the lip. Actually, all she needed was a small Abbe flap to release the lip and create a central philtrum. Her proud nasal tip had impressed me more than was justified. As I realized later, this incomplete cleft already had some columella, which gave her a better prognosis for a near normal nose even with the prolabium incorporated into the lip.

OFF TO KOREA

My next couple of experiences with primary bilateral clefts represent the two extremes and occurred immediately after my arrival in Korea to join the First U.S. Marine Division early in 1954. One was with a two-month-old baby who had a severely
projecting premaxilla, was unable to suck and was dying of malnutrition. As shown in Plastic and Reconstructive Surgery, November 1955, resection of a portion of the vomer allowed incorporation of the prolabium into the lip with bilateral straight-line closure but with depression of the nasal tip. Ten days later the baby was on the breast and gaining weight!

My second severe bilateral cleft in Korea was a 10-year-old native boy with a wide cleft and a small prolabium which inspired me to use an Abbe flap.

Thus my two Korean bilateral cleft cases were at the opposite poles of surgery: premaxillary setback with straight-line lip closure and prolabium into the columella with an Abbe flap. It occurred to me even then that there must be a better way and the answer probably lay somewhere between these extremes. Nevertheless, the potential of a primary Abbe flap deserves and will get a little chapter all its own (Chapter 14).

SUBSEQUENT EVOLUTION

Back in Miami, Florida, U.S.A., starting in 1956, a two-stage rotation-advancement approach was developed in bilateral incomplete clefts, and when the original columella was of adequate length the results were quite good. After refinements such as muscle approximation, this general approach is advocated today in incomplete clefts with an adequate columella and will be described in detail in Chapter 15.

In asymmetrical bilateral clefts in which one side was complete
and the other incomplete, the rotation-advancement principle was developed also, but here again the columella was short, at least on the complete side, and so produced unsatisfactory results requiring later surgery.

In complete bilateral clefts the columella is invariably short. I began, therefore, to incorporate the secondary forked flap into the primary lip plan. First it was used as a delayed procedure several months after a one-stage straight-line closure of both clefts. When the importance of introducing lateral lip muscle and mucosa behind the prolabium was fully realized, this principle was incorporated. The addition constructed good lips which were not anxious to give up a forked flap. Thus the columella lengthening had to be postponed, and the children reappeared in the clinic year after year with shortchanged noses until I began to see these snubbed noses regularly in my sleep. Finally they pressured me into a primary forked flap, but after a modest series the subsequent observations over months and years revealed a better potential nose but a long lip in vertical dimension. When the hazards of this radical approach were matched against the advantages, the method was discontinued. It was then that a different type of delay of the forked flap was incorporated which banked it during the primary bilateral lip closure so that it could be used several months later. Again, the despised syndrome of long vertical lip length was eventually revealed, especially in the complete clefts. Thus the final plan which is used today was evolved and will be described in minute detail in Chapters 26, 27, 28, 30 and 31 for incomplete, combined incomplete and complete and complete bilateral clefts of the lip with short columella.

Before becoming involved in the detail of more standard approaches it is well to study the two extremes of primary handling of complete bilateral clefts, the adhesion and the Abbe flap.
The so-called lip adhesion procedure in one or two stages is a modified lip closure that will serve to pull back at least to some degree on the projecting premaxilla. According to Leo Clodius of Zurich, Simon in 1864 attached two lateral lip flaps to the prolabium to pull the premaxilla back prior to a definitive lip closure. He made the point that a "vital indication" is not to disturb the premaxilla and its future function even at the disadvantage of a less attractive early lip repair.

In fact, this seems to be the first true adhesion procedure. It was radical, to be sure, but it achieved bilateral attachment, which, after its restraining action had served its purpose, was revised to what Simon probably considered an artistic lip reconstruction.

This adhesion operation by Simon has become the basis of a fascinating controversy. While with Gillies at Rooksdon I worked with Holdsworth who referred to the residual congenital skin bridges with or without muscle that occasionally span the upper part of a lip cleft as "Simonart's" or "Simonartz" bands. Since then I have been guilty of using this term loosely. In 1976 intellectual Tom Gibson, intrigued by these terms, started an intensive search for their origin and found that Gustav Simon in his 1868 book had presented the above operation for bilateral clefts. Gibson then deduced that someone subsequently must have written about repositioning of the premaxilla by creating the transverse bands of "Simon Arzt in Rostock" which is an operative band and not a congenital one. This no doubt solves
the name origin of the fictitious Simonart’s band which I propose could now be designated *Gibson’s bridge*, not by priority but by forced default.

Bengt Johanson of Göteborg, Sweden, a modern Viking with the sagacity and canny confidence to explore unknown waters, in 1958 first used a mucosal flap adhesion to create a bed for his early primary bone grafting. By 1961 he began to realize that primary bone grafting was contraindicated but that the adhesion was possibly having a beneficial molding effect on the maxillary segments.

He and Ohlsson wrote in 1961:

The line of incision along the lip cleft lies inside the skin and mucosal margin, in bilateral cases leaving the prolabium almost intact towards the premaxilla. This avoids troublesome scars and loss of tissue prior to a later more thorough lip closure, but secures the desired muscular influence on the upper jaw.

By 1968 he had developed his surgical plan, which at one month of age closed the hard palate by a turnover vomerine flap and created a mucosal lip adhesion and at six months closed the soft palate, leaving the definitive lip surgery until a year and a half. This is his routine today, and he feels that the early adhesion restrains the premaxilla to aid in its eventual maxillary alignment.

In 1958 I used an early, simple attachment of lateral vermilion flaps to overlap the prolabium vermilion at one month of age to bring blood supply to the prolabium. This action was in preparation for an early columella lengthening at three months. An incidental dividend of the approach was the partial retropositioning of the projecting premaxilla. In 1963 I created my first preliminary adhesion for the sole purpose of stalling closure of a wide cleft and giving time for maxillary molding. This was a high mucosal flap adhesion, described in 1964 and used selectively ever since.

In 1965 the precise and diligent Peter Randall of the University of Pennsylvania also proposed the lip adhesion as a preliminary procedure. Then in 1971, once with Hamilton and again with Graham, he presented asymmetrical bilateral clefts in which
only the completely cleft side was subjected to adhesion. This maneuver has the same sound logic as closing the worst side first for it takes a step toward symmetrizing the sides prior to the definitive closure. Finally, in 1972 Randall reported his follow-up feelings in *Plastic and Reconstructive Surgery*:

I am continuing this operation with enthusiasm. . . . It has been particularly useful in handling the protruding premaxilla in cases of complete bilateral clefts, and has made it unnecessary to use external elastic pressure or internal dental appliances in these cases.

He admits in typical honesty:

The operation does add another surgical step. Even though the procedure is carried out in tissue which is ordinarily discarded in the lip repair, some of these patients have presented appreciable scar at the time of the definitive lip repair.

This point I feel is important because actually nothing, and I mean nothing, should be discarded in such clefts, and to add scarring in order to avoid elastic traction is questionable.

Randall has begun to select his cases, which seems a wiser course:

For several years a lip adhesion was performed in this clinic as a preliminary operation on all children with complete unilateral and bilateral clefts. This does not seem to be necessary and is not being done at the present time. If the lip segments can be approximated with little difficulty, a lip adhesion is not carried out; the definitive closure is done as the primary operation. . . . In bilateral clefts only one side is done at a time.

But this makes two stages out of a simple adhesion procedure!

In 1970 Takahashi of Tokyo incorporated what he referred to as the Randall adhesion for a preliminary procedure in preparation for a forked flap bilateral cleft closure.

Meanwhile Walker, Collito and Meijer continued their C-W (Collito-Walker or close and wait) technique of simple approximation of cleft lip edges with absolutely no undermining. This type of adhesion they claimed always produced a favorable arch form which did not deteriorate. Here is an example that Meijer forwarded in 1974.
In 1971 Cronin and Penoff succinctly placed the adhesion procedure in its rightful place:

Rather than compromise a definitive lip repair by attempting to close it over a markedly protruding premaxilla, lip adhesions may be performed if adequate progress is not being made with head cap and elastic, or particularly if the infant lives at a distance, it may be done as the initial procedure.

**A LOW ADHESION**

K. Hollmann of the University of Vienna, in an abstract at the 1973 Copenhagen Congress, reported his use of the lip adhesion in 27 bilateral cleft cases. Anxious for early minimal soft tissue approximation because of its growth stimulation and premaxillary molding, he advocated attachment of mucosal flaps from the lateral lip elements to the inferior vermilion of the prolabium at one week of age.

His action and timing are very similar to what I used in my first 1958 adhesion in a bilateral cleft. The only difference is that he tucks the lateral flaps under the prolabium vermilion instead of overlapping them. This is a step I have long since abandoned but it still may have value in the very small prolabium.
Another type of preliminary adhesion that originated in northern Yugoslavia does not actually involve the lip but accomplishes some of the same goals possibly in a better way. Professor Franc Celesnik, trained by Costecka in Prague and Trauner in Gras, became Director of the Maxillo-Facial Clinic of the Medical Faculty of the University of Ljubljana, Yugoslavia, and organized a cleft palate center there. In 1962 Celesnik described a two-stage procedure for bilateral clefts with the first stage serving as a type of adhesion procedure. In the first operation the bilateral total cleft lip was transformed into a bilateral partial cleft lip by closing the floor of the nose on both sides.

In the second operation three months later, the definitive lip closure was accomplished on both sides by the straight-line Veau technique.

In September 1973, the very month of Professor Celesnik's untimely death, Zvone Zajdela of the Medical Faculty of Ljubljana published “Celesnik Procedure in the Surgical Treatment of Bilateral Complete Clefts” on 55 cases from 1957 to 1972. At four months of age the alveolar clefts were closed bilaterally, the floor of the nostril was formed and the upper fourth of the lip was closed.

The nostrils are fixed on both sides with a muscle flap, taken from the soft tissues of the cheek and fastened through the nasal septum as suggested by
Margaret Hotz... and Celesnik... for the unilateral cleft. The reconstructed floor of the nostril is then covered from the lower side with a flap from the buccal mucosa as described by Burian... The advantages of this method are the following: pressure on the base of the premaxilla is created, repositioning the premaxilla dorsally, the development of the prolabium is better and symmetry on both sides is achieved with greater ease with an orthodontic appliance, shifting of the premaxilla downward is prevented and secondly, the expansion of the lateral segments of the upper jaw is ensured.

Under this regimen, the remaining lip cleft receives a Veau closure at least six months after the first stage, the soft palate is approximated at one year, the columella is lengthened at three to five years and the hard palate is closed at six to seven years.

A CELESNIK DISCIPLE

Another Celesnik contribution to clefts was the training of Yugoslavian Milivoj Perko, who claims to be his oldest student and is now chairman of the team for Congenital Jaw and Face Deformities in Infancy at the Oral Surgery Institute of the University of Zurich. At the International Cleft Palate Congress in Copenhagen in 1973, Perko and Margaret Hotz presented their conclusions after six years of combined management of bilateral clefts. Hotz is a remarkable combination of pediatrician, orthodontist, prosthodontist and speech pathologist. She swings into action first with preoperative orthodontic plates (with or without expansion screws), relying on natural growth to get approximation and alignment of the three segments. As Hotz explains:

Extraoral traction is not used to retrace the premaxilla in the first place, but to prevent it from developing any further. Widening of the lateral segments is necessary because of rapid growth of the lower jaw during the first six months. Our aim is to keep the upper arch wide enough to encompass the mandible. Postoperative retention and control are necessary in order to maintain normal jaw relationship.

Then at about six months of age Perko executes a Celesnik I closure of the anterior nasal floors bilaterally. He claims these advantages:

1. Tilting of the premaxilla does not occur, as it will be pushed backward bodily.
2. Growth of the prolabium occurs more rapidly after repair of the nasal floor.

3. The premaxilla will be fixed in a midline position which facilitates symmetric closure of the lip.

Yet during the Copenhagen Congress Perko admitted to me informally that he was beginning to doubt the true value of the early nasal floor adhesion of Celesnik. He expressed some concern over possible effects on growth even with this limited surgery and suggested it might be unnecessary when orthodontic manipulation by his team of Hotz and Wanda Gnoinski was proving to be so effective.

Two to three months after the nasal floor adhesion, Perko carries out what he refers to as Celesnik II stage but which is the definitive lip closure. In Perko’s hands it is actually a Veau or Manchester procedure postponing release of the nasal tip. As he says,

I prefer to perform the columella plasty later on, using your forked flap.

It is my “gut” feeling that the adhesion principle in bilateral clefts is a procrastination which is justified only if the surgeon is inexperienced, timid or without orthodontic assistance or when the premaxilla protrudes persistently and in spite of preliminary traction beyond a reasonable point for definitive closure. It seems wiser to manipulate the premaxilla element with prosthodontic and external pressures than to add further operations in preparation for a final lip closure. The adhesion will not put the kind of restraint on the premaxilla that a muscle-to-muscle closure from the lateral elements under the prolabium over the premaxilla can exert. Therefore, if it is relatively easy to get muscle-to-muscle closure, it will be more effective anyway. Bypassing this mincing step saves some tissue and avoids scarring.

A TINY EXCEPTION

When the prolabium is truly diminutive, early adhesive attachment of its sides to the lateral lip elements with mucosal flaps may be indicated. They will stretch it into a more than respectable philtrum, thus creating forked flap material and at the same time restraining the premaxilla.
AN ADHESION POLL

Resident John Osborn of Toledo in June 1974 completed a survey of 80 residency training programs in the U.S.A. and Canada. The response to the use of lip adhesions for either unilateral or bilateral clefts was affirmative in 27 (34 percent). The affirmative response is likely to increase over the next few years.
14. Primary Abbe Flap

At the very end of the nineteenth century Robert Abbe switched a full-thickness flap from the lower to the upper lip in a secondary bilateral cleft and became immortal among plastic surgeons. He did not propose that his flap be used as a primary procedure and probably would shudder at the thought. Nevertheless, on rare occasions this action may be justified.

My first primary Abbe flap was carried out on Kim Moo Uy, a 10-year-old Korean boy with a severe bilateral cleft of the lip and palate. Early treatment by a marine dental lieutenant had inadvertently lost the premaxilla. As the palate gap was so large, this aspect was treated first. Then, in the fall of 1954, the diminutive prolabium was shifted into the columella position and a small shield-shaped primary Abbe flap was switched to create a natural philtrum for his upper lip. This was probably one of the first primary Abbe flaps ever used in bilateral lip clefts.

Gillies had previously discussed with me the possibilities of a primary Abbe flap, but up to 1953 no primary flaps had been done as far as I know.
A DELAYED PRIMARY LIP-SWITCH FLAP

A delayed primary Abbe flap had been used by Rainsford Mowlem of London in an infant from Egypt with a severe bilateral cleft and a diminutive prolabium. In his typical no-nonsense approach, he had left the inadequate prolabium dangling from the tip of the nose and closed the lip elements beneath it. This procedure avoided dragging the nose into the lip in "this little Naomi from the rushes of the Nile," and at 10 months the lip was released and the defect filled with an Abbe flap as a delayed primary action. The case was published in The Principles and Art of Plastic Surgery, 1957, by Gillies and Millard.

Pioneer work like this points to the loss suffered by cleft surgery when Mowlem, in his prime, turned over his flaps to Dawson, packed up and exiled himself to Spain. Here, it is reported, he sits in the shade of his villa overlooking his estate while an attendant named Jesus rides an ass up and down his groves collecting baskets of oranges and lemons.

INSERTED INTO THE PROLABIUM

Patrick Clarkson trained with Gillies at Rooksdown House during the war and served as plastic surgeon to the fractured faces and limbs of the British forces in the Italian campaign. He returned to Guy's Hospital in London but contributed a day a week at Rooksdown House. His mumbled humor, his suave

184
manner and the ever present carnation in his lapel were a success at Harley Street. He was bold without caution on the road, at a party or in the operating theater.

In 1955 Clarkson stated:

Sir Harold Gillies tells me that primary Abbe flaps have been done in his service on occasions before. This note is simply to report the start of another investigation into the value of this flap. I have done two of these primary Abbe flaps at Guy’s Hospital towards the end of the first month of the child’s life. I repeat the view that it is undesirable to delay unduly the primary lip repair whether it be a simple or double cleft. . . . To my mind the crux of the deformity seen in severe double clefts of the lip and palate is that there is a deficiency of both soft and hard tissues. Current methods of repair from adjacent tissues give a high percentage of very unsatisfactory results—with flat, tight upper lips and collapsed upper alveolar arches.

Interestingly, Clarkson did not even mention the short columella and depressed nasal tip. It is possible that, although his own nose had been flattened in boxing, his successful early days as a dashing gentleman among the ladies caused him to have little concern over any flat nose. He switched the lower lip Abbe flap into a split in the prolabium without using this prolabial tissue to help the columella. Evidently he was more concerned about breathing during the time of flap attachment:

I have done this operation under local analgesia supported by an ounce of port wine. Because of the potential difficulty to breathing which attachment of the flap to both sides of the cleft at one stage might cause, I have attached one side at a time—doing the second side about a week or ten days after the first. The base of the flap I have cut at about three weeks.
It would seem to me that Clarkson stopped short of his potential. At least he did have the possibility of lengthening the columella with a forked flap of the entire prolabium at a later stage, as he already had lengthened his Abbe "philtrum" in the lip. In fact, this might be the treatment of choice now for the surgeon attending these two cases. The patients would be about 19 years old today and probably still have flat nasal tips if no further surgery has been done.

**FULL CENTER OF LIP**

Ten years later, in 1966, Bombay’s Noshia Antia, one of Gillies’ favorite students and a leprosy expert, reported 10 cases of primary Abbe flaps in bilateral clefts in the *British Journal of Plastic Surgery* and showed one beautiful result. In his high, cultured voice he postulated:

A stage must invariably come when the tissue available in the prolabium, columella, and the lateral elements is just not enough to produce an adequate lip or a columella and often both. No amount of tissue juggling can produce an adequate result. . . . It is evident that the prolabial element is not truly a part of the upper lip but is the displaced upper half of the columella which is tethered to the premaxilla. The lower half of the columella and the central half of the upper lip are totally missing. Even the most economic use of local tissue cannot adequately repair this upper lip and an Abbe flap represents an excellent solution to this problem.

Antia commented on what others have feared:

The only justifiable argument against a primary Abbe flap . . . is scarring of the lower lip and possible danger of such an operation to the life of the patient when it is carried out at an early age. Although the majority of the patients operated in this series have been over one year of age, in my experience this operation should not carry any greater risk . . . provided that adequate pre-operative and post-operative precautions are taken. The services of a skilled anesthetist who is aware of endotracheal intubation, fixation of the tube, and adequate airway in the immediate post-operative phase are absolutely essential for the success of this operation.

Antia closed the anterior palate and then took a central Abbe flap a little over half the width of the upper lip defect and long enough to assist the columella if necessary. He noted that during the flap attachment,
contrary to what one might think, feeding is not a problem.

**Dutch Abbe**

In 1967 at the Rome International Congress, Cornelius A. Honig, of the University Hospital, Utrecht, The Netherlands, presented some interesting primary Abbe flaps in bilateral cleft cases. The blond Honig, who recalls,

In good winters one could skate on ice from one town to another,

fits my image of *Hans Brinker and the Silver Skates*. This was his logic in relation to primary Abbe flaps in bilateral clefts:

In clefts of the primary and secondary palate, the primary deficiency will be clearly visible in the result, principally in the volume of the upper lip in proportion to the rest of the face and in the length of the columella. The extreme shortness of the columella produces the typical nasal deformity with the tip of the nose pulled downwards to the upper lip. . . . In the past five years we have modified our technique in these cases and we use the skin from the prolabium to lengthen the columella, and we close the defect in the upper lip with an Abbe transposition flap.

In 1973 Honig, living on a small farm with a delightful two-acre pond full of fish, wrote me his latest thoughts:

My present view on facial clefts is that treatment should depend on the extent of the tissue defect in each case. Unfortunately there is no method by which one can measure the extent of the defect, so one can only give an inadequate estimation. In some cases we still do a primary Abbe flap for bilateral cleft lips.

**South of the Border Abbe**

Reasoning that an untreated prolabium and columella in an adult maintain the same proportions with the facial features as exist at birth, or “once short, always short,” pressured Micheline Viale-Gonzalez and Fernando Ortiz-Monasterio of Mexico City into Abbe action in 1970. When the columella and prolabium are both short, they shift the prolabium into the columella and use a primary Abbe flap for the lip defect. This maneuver, of course, ignores the well-known fact that attaching the lateral lip segments to the prolabium starts a stretching exercise that soon presents plenty of prolabium for both lip and nose.
KEY TO CODE ON CASES

CL = cleft lip
CP = cleft palate
B.D. = birth date
F.H. = family history
F.T. = first trimester
O.C.A. = other congenital anomalies
R-A = rotation-advancement
H.P. = hard palate
S.P. = soft palate
F.F. = forked flap

A cleft is indicated by stippling, a submucous cleft or submucous distortion by horizontal lines.

MY SPECIFIC BILATERAL CL STATISTICS

Out of 52 personal primary bilateral clefts of the lip chosen (about 98 percent consecutively) for presentation in the various chapters of this book, there are 11 incomplete on both sides, 9 asymmetrical with one side complete, and 32 complete on both sides.

<table>
<thead>
<tr>
<th>Incomplete (11)</th>
<th>Asymmetrical (9)</th>
<th>Complete (32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male 7</td>
<td>Male 7</td>
<td>Male 23</td>
</tr>
<tr>
<td>Female 4</td>
<td>Female 2</td>
<td>Female 9</td>
</tr>
<tr>
<td>F.H. + 3</td>
<td>F.H. + 0</td>
<td>F.H. + 7 known</td>
</tr>
<tr>
<td>F.T. + 1</td>
<td>F.T. + 2</td>
<td>F.T. + 4 known</td>
</tr>
<tr>
<td>O.C.A. 0</td>
<td>O.C.A. 1</td>
<td>O.C.A. 4</td>
</tr>
<tr>
<td>CP 8</td>
<td>CP 8</td>
<td>CP 29</td>
</tr>
</tbody>
</table>

Of the 52 total, 71 percent are male and 29 percent female; 9.6 percent have O.C.A. and 86.5 percent have associated CP. Of the 52, a family history was obtained in 40, and of these, 25 percent have F.H. of clefts and 17.5 percent have an incident in the F.T.

Bilateral incomplete CL cases have 72 percent associated CP while asymmetrical CL cases have 88.2 percent associated CP, and complete CL cases have 90.6 percent associated CP.
15. Adaptation of the Rotation-Advancement Principle in Bilateral Incomplete Clefts

When the rotation-advancement principle was being developed in unilateral clefts in Korea, it did not occur to me that the same principle might be of value in bilateral clefts because there was no vestige of a cupid's bow. Once the method caught on in unilateral clefts, surgeons began to ask about its application in the bilateral problem and I turned my attention to the possibility. This is its evolution.

My original adaptation of rotation-advancement in bilateral incomplete clefts included a design lengthening the short prolabium. In 1960 in Surgery, Gynecology and Obstetrics I wrote:

In bilateral incomplete clefts the columella is usually of adequate length and the nasal tip is in normal position. The discrepancy in vertical frontonasal length lies in the shortness of the prolabium. . . . A logical approach would seem to be division of the short prolabium from the normal nose component so that it can be moved down into the natural philtrum position in the lip. Maintenance of this correction can be achieved by advancement of lateral lip flaps into the gap between columella and prolabium.

In four stages

The first incomplete bilateral cleft case in which the rotation-advancement principle was used was published in the Transactions of the 2nd International Congress of Plastic Surgery. It was not ideal
as the columella was moderately short. Being experimental, the surgery was staged conservatively in multiple steps.

On November 27, 1956, the lateral vermilion flaps were used to overlap the turndown flap of inferior prolabium vermilion. This procedure created the effect of a cupid’s bow and ensured a tubercle but, as I wrote in my operative note at the time, it was most important to give a blood supply to the prolabium for later work.

Evidently I had some concern about the vascularity of the prolabium if it were cut completely off from the nose by bilateral rotation-advancement incisions.

Two months later a right-sided rotation-advancement procedure was carried out, and five and a half months later the left side was treated identically.

As could be predicted, the nasal tip continued to be flat and the alae wide so that on March 12, 1959, a modified forked flap lengthened the columella moderately and reduced the alar flare.
REDUCED TO TWO STAGES

In a case published in *Surgery, Gynecology and Obstetrics*, November 1960, the columella was closer to normal length so the patient was a more nearly ideal candidate for bilateral rotation-advancement. Since the separate primary stage of overlap of lateral vermilion flaps over the inferior prolabium vermilion was no longer considered necessary, at least in incomplete clefts, this aspect was incorporated in each rotation-advancement maneuver. The closing of one side at a time reduced the bilateral closure to two stages.

At three months of age a right lateral vermilion flap was used to overlap the turndown flap of the right half of the prolabium vermilion. A triangular wedge was excised from the nasal floor.
Several minor revisions were subsequently carried out including deep tissue excision from the center of the prolabium and insertion of a dimple stitch which was more impressive early in the postoperative period than after a few years. As was predicted, the columella is almost long enough.

Two months later the left side was rotated and advanced in the same manner except that excision of the traumatic scar area made it necessary for the left advancement flap to cross the midline, introducing more tissue than was ideal above the prolabium. This discrepancy was reflected in the later development of this lip.
At the International Congress in London in 1959 I suggested that the rotation-advancement principle was applicable in bilateral clefts of the lip:

Yet placement of normal tissue in normal position does not pertain to the cupid's bow in as much as bilateral clefts have no residual bow. The normal element rather is the prolabium which belongs in the center of the lip as a philtrum and can be kept there by the same rotation type incisions. . . . The key factor in the approach to the bilateral cleft lip closure is the original length of the columella. In bilateral incomplete clefts, the columella is usually of adequate length while the prolabium is diminutive.

Thus:

Lateral triangular lip flaps can be advanced across the cleft, one side at a time, until they touch tip to tip above the prolabium and in fact completely separate the columella from the prolabium.

The turndown of each lateral lip vermilion to overlap one-half of the turndown flap of prolabium vermilion was suggested to *preserve but hide* the questionable prolabial vermilion and at the same time create some semblance of a cupid's bow.

This adaptation of the rotation-advancement principle offered certain advantages. The prolabium was maintained and shaped as a natural philtrum, advancement of the lateral elements reduced the alar flare and the scars of union were placed along philtrum column positions. However, complete division of the prolabium from the columella and introduction of lateral lip tissue between them added unwanted vertical length to the prolabium. Vigorous muscle tugging on the prolabial “bobbin,” which had been cut free from its mooring, eventually was responsible for excessive vertical upper lip length. Even in incomplete bilateral cases the columella, although not so drastically short, invariably will be found to have some inherent shortness. The transverse division of prolabium from columella theoretically burned any bridges to a secondary forked flap. Actually it was found that a forked flap with the aid of a surgical delay can be taken across scar lines as well as along them. Here is a case to prove it.
FIRST CASE OF ASYMMETRICAL CLEFT CLOSED IN THREE STAGES

An asymmetrical and difficult case came to me in 1958, and the early results were published in the *Transactions of the 2nd International Congress of Plastic Surgery*. Even though the columella was short on one side, the rotation-advancement design was planned. *Closure of the complete and worse cleft side first was logical.*

1. It maintains blood supply from the incomplete bridge.
2. Cleft closure gives molding to the wayward premaxilla on the complete cleft side.
3. When there is a deviation of the premaxilla, it usually leans away from the widest cleft, and by closure of this one first, the premaxilla is pulled toward the midline, correcting the deviation and bringing some symmetry to the maxillary arch components.

When the columella in the original deformity is short, it will eventually require lengthening. In this case a forked flap was fashioned finally.

Here was an asymmetrical cleft with one side complete so the precaution was taken to attach lateral vermilion blood supply to the inferior prolabium. Later this safety measure was found unnecessary. At three months of age a first-stage procedure was done in which vermilion flaps from the cleft edge of the lateral lip elements were used to overlap the turndown of prolabium vermilion.
Lateral vermilion flaps overlapped prolabium vermilion.

One and a half months later the more severe cleft was rotated and advanced and flap c was used in the nostril sill.

Two weeks later the right incomplete cleft side was rotated and advanced with a wedge resection of the nostril floor.

At two and one-half years of age a forked flap was used to lengthen the short columella.
Comment. Forked flap following bilateral rotation-advancement proved that forks could survive even after total division across their columella base!

One week later the little patient was thrown to the floor of the car while his parents were driving home to North Carolina and the forked flap was disrupted. The baby was brought back to Miami, and the flaps were resutured. Then in 1963 at St. Joseph's Hospital, Asheville, North Carolina, the forked flap was modified to improve the columella and shorten the lip. A photo was sent from North Carolina dated January 10, 1964, at age five years.

Then in 1975, another follow-up photo revealed the excellent development of this young man at 17 years. He was recalled in 1976 and had both secondary nasal and labial corrections. The skin scars were excised and lateral muscles joined across the midline under the prolabium. Corrective rhinoplasty included hump removal, septal shortening, alar cartilage reduction with lift on the cleft side, submucous resection, and septal cartilage strut grafts into the columella for tip and alar support.

ANOTHER ASYMMETRICAL CLEFT CLOSED IN TWO STAGES

A baby born in the Bahama Islands had bilateral clefts, incomplete left, complete right, shorter columella on the right with
At two and one-half months of age, the right complete cleft was rotated and advanced and the lateral vermilion flaps were used to overlap the right half of the inferior prolabium vermilion. Closing the complete cleft side first made it possible to preserve the bridge blood supply from the incomplete cleft, and once it was closed, there could be molding of the rotated premaxilla.

One and a half months later the left incomplete side was rotated and advanced and vermilion was overlapped to complete the closure.

Comment. Short fork will be necessary eventually.
This example reveals the method’s ability to fashion the prolabium to philtrum shape but also proves that any shortness in the columella persists and eventually will require surgical correction.

AND ANOTHER

Rotation-advancement closure of the incomplete cleft was done on the left, and minor revision of the vermilion notch and mucocutaneous discrepancy was made on the right.

Lip revision and closure of the palate cleft were carried out with pushback and island flap.

Last seen by Frederick Remark, at four and a half years of age this little girl required vermilion revision and hearing evaluation.
In 1974 Miroslav Fara of Charles University, Prague, visited Miami. During our many enlightening discussions he mentioned that he had used the rotation-advancement principle in bilateral clefts but had interdigitated the tips of the advancement flaps one on top of the other across the midline in an attempt to get some muscle across the cleft. As would be expected, he soon found the vertical length of his lips after this was far too long!

A CONCLUSION

As experience increased, it was realized that at least a narrow bridge of original connection between prolabium and columella base should be maintained at least during the early years and the lateral flaps not advanced quite tip to tip. In other words, most prolabiums are long enough or will be, even though they may appear short at first. If at five years the columella must be lengthened, then it is probably safe to go ahead with the forked flap.

BILATERAL R-A REDUCED TO ONE STAGE

A symmetrical bilateral incomplete cleft with columella of only slight shortness presents the best type of case for rotation-advancement. At this time the lateral lip mucosa and muscles were not being joined routinely behind the freed prolabium. Thus it was possible to complete the bilateral rotation-advancement by not dividing completely through the prolabium join with the columella base, and one of the important improvements in this approach was realized. Maintaining some original attachment between columella and prolabium prevented the unnatural early vertical stretching of this upper lip. As would be expected, this lip has developed well during the years of growth.
Because of the incompleteness of the cleft there was little lateral vermilion available for overlapping the prolabium. Thus, the lateral vermilion flaps were extended up posteriorly and vertically along the lateral side of the cleft to pick up extra length and, as seen, adequate vermilion was obtained.
Beware the Hybrid

Here is an example of an incomplete bilateral cleft lip treated by what might be loosely called a rotation-advancement approach. The shortcomings of this result are not the fault of the method but are due to the failure of correct execution. The lateral advancement flaps join above the prolabium over too great a distance, giving a stuck-on appearance and preventing the prolabium from imitating a philtrum. The prolabium vermilion has been retained in visible position, resulting in an uncraftsmenlike free border with a whistling deformity. Revision is difficult.

A Selective Gain

Meanwhile, the pure rotation-advancement method, having caught on in unilateral clefts and having been proposed for certain bilateral cases, was gradually gaining selective popularity even in the camps of the opposition.

In 1971 from Houston, Texas, Thomas Cronin with James Penoff agreed with limited use of the rotation-advancement and reported having done 7 out of 71 bilateral clefts. They wrote an honest appraisal:

The Millard rotation-advancement was used exclusively for the incomplete cleft with very small prolabium. The prolabium was rotated downward in two stages to fit the lateral segments and the probial vermilion was augmented with a vermilion muscle flap from the lateral lip segment. . . . Six to eight weeks should elapse between stages to allow for recovery. . . . Care should be taken to avoid advancement flaps as this tends to result in a long lip vertically.

In 1974 Cronin forwarded to me this lovely example of his bilateral incomplete cleft, which, as he said, has been corrected by a rotation-advancement (Millard) repair.

The case was presented in Boston during the 1970 Kazanjian honorary lecture and in 1971 was published in the Cleft Palate Journal.
Ray Broadbent and Robert Woolf of Salt Lake City gave their evaluation in 1972:

A bilateral repair with Millard’s design, done simultaneously, seemed far too precarious for the central prolabium. There were, however, theoretical and actual advantages to this type of repair—but for safety, we staged it one side at a time. A better scar pattern on the lip resulted, and these scars could be placed out of the mid-nasal floors. This positional change, with a flap threaded across each nasal floor, went a long way toward avoiding the grooved nostrils and their persistent “dirty nose” appearance. The flat nose was somewhat improved, but still flat. However, these changes constituted improvement—but the prolabium remained attached to the premaxilla, and it was associated with an inadequate labial sulcus and a deficient central tubercle.

They did end with:

A Millard design could be used when the operator thinks the lip should be closed one side at a time.

Of course, the rotation-advancement method was not designed originally as a one-stage procedure anyway. The present redesign makes this possible and at the same time corrects all of Broadbent’s objections except the flat nose. The pure rotation-advancement method has never been and still is not advocated for patients with a short columella. Yet in too many instances the principle was being used without selection even when the columella was very short. As noted, I had been through this phase and
discontinued indiscriminate use of pure rotation-advancement about 1965. Yet the trend continued, and evidence of it has come to my attention from time to time. As Bruce Williams wrote in 1973:

If the cleft is not wide or is incomplete, a bilateral rotation advancement is done at the first operation.

Having thus painted himself into a corner, the surgeon is forced into one of three undesirable choices: be content with a columella short of normal, return to the lip for adequate tissue or advance the nasal floors and alar bases for a slight gain. Consequently too many nasal tips were remaining depressed.

A 1968 paper by Tabuya Onizuka, then of the Department of Plastic Surgery, Central Hospital of the National Railway Company, Japan, is of interest. Onizuka stated that in addition to the merits he had previously noted with Millard's method for unilateral clefts there were the following advantages in bilateral clefts, which evidently tempted him to use it even in the presence of a short columella:

1. Upper lip is pouting.
2. The "form" of the upper lip is near normal.
3. Cupid's bow is easily reconstituted.

He compared the results with other methods, presenting actual cases to prove his deductions.

1. **Straight-line closure** produces results in which the upper lip is tight, the lower lip protrudes and the V-shaped scar is opposite to that of the normal philtrum.
2. **Triangular method** may be able to get pout, but there is a tendency for concavity in the mid-portion of the upper lip, there is bulging under the columella and the scars are ugly and complicated.
3. **Millard method** gives beautiful pout, and scars run along the philtrum.

As was predicted, and as would be expected, Onizuka noted certain difficulties he encountered, most prominent of which were in the nasal area.
1. It is difficult to get a beautiful nose without a second operation.
2. Doing two operations on the nostril floor tends to cause hypertrophic scars in this region.
3. In young children the base of the columella slides down with growth.
4. The upper lip has a tendency to appear relatively long as a result of narrowing the alar portion of the nose.

**TIMING**

Onizuka’s plan of surgery closes the bilateral cleft in two stages at three and six months because the premaxilla blood supply is safer, complications are less and, after first-stage improvement, the form of the side operated on can be observed.

Onizuka finds the columella too short after this first-stage procedure. He sometimes uses what he calls Millard’s intermediate skin flap (flap c or one fork) which is transferred to the columella base by the transposition of Skoog. Unfortunately, all incisions gather in the nostril floor making suture difficult and sometimes resulting in delayed healing and hypertrophic scarring.

It is possible that this modification of columella lengthening may be sufficient for the Oriental nose.

**HIRSHOWITZ**

Gentlemanly Bernard Hirshowitz of Abba Khoushi School of Medicine, Haifa, was trained by Jack Penn in Johannesburg and in 1951 joined a team led by Penn to provide plastic surgical treatment in the newly established state of Israel. In 1952 Hirshowitz set up a plastic surgery service at Rambam Government Hospital, Haifa, which treated the wounded soldiers during three Arab-Israeli wars. In between hostilities he established the S.E.D. cleft palate center at this hospital. Pleased with the adaptation of the rotation-advancement principle in bilateral clefts, he developed his rendition in two stages. In the 1973 Copenhagen Congress abstracts he described two modifications that employ
the cleft edge mucosa. The vermilion of the lateral edge of the prolabium is cut as a flap based on the premaxilla, which is folded medially under the elevated prolabium over the raw front surface of the premaxilla to form half a sulcus. He claimed:

The under surface of the prolabium is initially unlined but re-epithelialization rapidly restores its mucous membrane surface. Almost no ensuing untoward effects by scarring follow this method.

The vermilion of the cleft edge of the lateral lip element is cut as an inverted V flap which is inserted into the deficient inferior prolabium vermilion leaving the intact vermilion skin border of the prolabium undisturbed. Hirshowitz summarized:

The curved medial skin incisions correspond to the philtrum lines, the rolled vermilion border is intact, the vermilion itself is full, and the nostril bases are rotated inwards. A short upper lip is ensured by not joining the two rotation-advancement incisions across the midline at the columella base.

Yet he must return into the lip later for, as he wrote,

Ample tissue enables columella advancement to be subsequently performed.

**MERVILLE**

Maxillofacial surgeon L. C. Merville of Foch Hospital, Paris, comprehends the importance of the columella in planning rotation-advancement. He wrote in 1971:

Millard technique—the operation is done differently according to the degree of the cleft: incomplete or complete, according to the degree of hypoplasia of the columella.

**A DEY IN SYDNEY**

Another surgeon who understands this columella aspect is David Dey of the Royal North Shore Hospital, Sydney. He trained primarily as a pediatric surgeon at Great Ormond Street, London, but exposure to Mowlem, Matthews and even Denis Browne caused him to become infatuated with plastic surgery. One cleft is born a day in Australia, and Dey gets one-quarter of the total. Evidently a percentage of his 90 clefts a year have a prolabium
with vertical shortness which is slightly more than one-third of the height of the lateral elements. Thus in a paper for the *Australian-New Zealand Journal of Surgery* in 1973, entitled “An Important Contribution of the Millard Flap to Cleft Lip Surgery,” he argued:

It has been stated on numerous occasions that the central “prolabia” element grows in a remarkable fashion following closure of lip clefts, particularly if it is freed posteriorly from the “premaxilla” and a gingivolabial sulcus established. . . . However, I have yet to see this expectation realized to an acceptable degree in these incomplete clefts following a simple-type closure, and the children all tend to be left with an upper lip in which the lateral elements sweep upwards and inwards in an unnatural fashion.

In 1968 Dey turned to the rotation-advancement principle to lengthen the short prolabium and, being a perfectionist, ran the gamut that I stumbled through, including the primary forked flap (without the forks) isolating the prolabium solely on the premaxillary blood supply. He suffered as, he said:

The isolated segment of prolabial tissue was alarmingly blue for two or three days, but eventually recovered completely without tissue loss and the final outcome proved satisfactory.

This scare caused Dey to turn to two stages, which in turn enabled him to slide lateral vermilion behind the prolabium for half a sulcus at each stage. He explained the details of his technique:

The medial curved Millard incision is then inked in, conserving skin by a wide sweep and reaching the midpoint of the columella where the latter joins the lip. It does not transgress the midline at this point, and is carried downwards directly for a short distance to allow the lip to lengthen to the proper degree. . . . A wedge of skin is removed from the nasal floor. . . . The red edge of the prolabium is retained and turned forward, reinforced by the red skin from the lateral lip.

In November 1973, when forwarding requested bilateral incomplete cleft cases to me, Dey added:

This procedure does seem to deal adequately with the uncommon bilateral incomplete cleft with a short prolabium. I personally find a lip with the two
lateral lip lines running upwards very ugly—and this was all too common before I read your article!

His results appear quite good, and except for his keeping prolabium vermilion visible the method checks out. This retention of the Manchester vermilion roll-out principle can perhaps be attributed to a loyalty to his friend and neighbor “down under.”

In 1974 Raymond Brauer admitted almost painfully:

To fit the longer vertical length of the lateral segments into the short prolabium, it is sometimes necessary to use the downwards rotational principle as recommended by Millard.

Over the years I have become less concerned with the need to lengthen a short prolabium. Most prolabiums are of sufficient length particularly when it is realized that the normal lip at rest should expose the lower one-fourth of the upper incisors. Often it is better to shorten the lateral segments and there are ways of using this extra tissue that will be described later.

In 1964 Cronin acknowledged his preference:

If the lateral lip segment is too long, a wedge consisting of the full thickness of the lip is removed.

Then too, early division of the prolabium from the nose tends to produce a lip that is abnormally long in the vertical axis, and this
can be worrying. There is, however, a rare prolabium that de­serves help. This fact is emphasized by two cases at the end of Chapter 26 where a short prolabium was rendered normal vertical length merely by introducing lateral mucosa and muscles behind it and lateral vermilion-mucocutaneous ridge flaps over its infe­rior vermilion.

A MEXICAN MODIFICATION

A variation in the design has been developed by José Guerrero-­Santos, who wrote from Guadalajara in 1973:

The Tennison procedure was abandoned by us several years ago, and as a rule in most of the cases, both my associates and my residents as well as myself are using the rotation-advancement technique.

When the lip is very wide, close one side; usually, if it is asymmetrical, the less-wide cleft, trying to change the lip into a unilateral cleft; and for the second stage we close it with the rotation-advancement method, combining it with the denuded and buried flaps.

I elongate the columella after the first year, and I do the incomplete clefts like the complete ones, using rotation-advancement combined with a denuded flap.

MODIFYING THE ADVANCEMENT

In 1958 in the American Journal of Surgery while discussing primary rotation-advancement in bilateral clefts I noted a possible modification in the advancement flap for severe clefts.
In extremely wide bilateral clefts the [lateral] triangular flaps are sometimes better transposed from a vertical position along the cleft to a horizontal position between columella and prolabium.

Actually this variation was never used because as experience progressed the smooth flow of pure rotation and advancement offered more natural action and scars than an abrupt transposition.

W Y N N

In 1960 Sidney Wynn of Milwaukee presented his vertical flap taken from the lateral lip element and transposed across the cleft high in the medial lip near the columella base. He also adapted this principle to bilateral clefts, accomplishing primary closure in two stages.

Of course, there are the advantages of high medial release and lateral advancement, but the kink of a 90-degree transposition not only leaves a pig’s-ear in its wake but results in a square philtrum and fails to achieve the natural curved effect of the true rotation-advancement action and scar placement. Like the rotation-advancement, transposition, by introducing tissue well below the columella, tends to lengthen the prolabium rather than the columella.

T H E  S T A N D A R D  T W O - S T A G E

In 1968, for Grabb and Smith, I described what in my opinion is the best two-stage method of closing an incomplete bilateral cleft, but only if the columella is definitely of normal length. Two important changes in the original design were added: (1) Muscle and mucosa were introduced behind the prolabium a la Meyer-
Schultz, but in stages, in the manner of Bauer, Trusler and Tondra. (2) Prolabium-to-columella continuity was not divided completely, for the lateral flaps do not meet each other across the lip, maintaining the original vertical length in the midline.

**ONE STAGE IS PREFERABLE**

If, during bilateral cleft lip closure, tension can be controlled and adequate blood supply preserved, one stage is better than two because of the merits—economy of time, facilitation of surgery and maintenance of symmetry. Much effort is warranted to develop a one-stage procedure, but it must be fundamentally sound.

A one-stage rotation-advancement for a bilateral incomplete cleft was presented in my Chapter 20 in *Cleft Lip and Palate*, edited by Grabb, Rosenstein and Bzoch. Here a procedure was diagramed which in general has possibilities, but the specific rendition suffered a touch of surrealism. The skilled artist Fred Harwin was given the unenviable task of improving drawings submitted to him. My failure to police this work resulted in
sketches that revealed artistic excellence but plastic fantasy. It was my responsibility to spot faults prior to publication but only when writing the present chapter did I actually focus on these discrepancies, and I now hasten to warn the inexperienced.

The first mistake, which is also made by many surgeons, was to use a rotation-advancement approach when the columella is short. The second was to treat the lateral prolabium as excess to be discarded when the columella is so short. This is throwing away a "forked flap," but then surgeons are guilty of the same mistake. The third had to do with vascularity. In a procedure that introduces lateral lip muscle and mucosa behind the prolabium across the premaxillary vascularity, it is hazardous to advance the lateral skin flaps almost across the remaining prolabium blood supply at the base of the columella. To have these flaps come within 2 to 3 mm. of tip to tip in one stage produces a vascular "cliff-hanger." Harwin did recover by drawing the stitched stage with an adequate base at the columella. Finally, his last stitched sketch places the circumalar scars too far down in the lip and portrays a convex prolabium turned into a philtrum dimple without the stitch to do it.

The general rotation-advancement principle is applicable in all bilateral clefts but its application in pure form should be limited to incomplete clefts with adequate columella. This is an exceedingly rare occurrence. Certain bilateral incomplete clefts, however, do have a columella that is only slightly short. These can be closed by the pure rotation-advancement with the bilateral refinements in one stage and subsequently have the columella elongated slightly by the Carter-Cronin principle if necessary.

Here is the modern design for this special group of cases after an evolution influenced by my experience and the experience and suggestions of others.
Bilateral One-Stage Rotation-Advancement

Columella near normal.

Bilateral upper rotation-advancement incisions do not meet across the midline.

Lateral parring flaps (1 and 2) of the prolabium used to cover raw anterior premaxilla.

Cupid’s bow incision on inferior prolabium placed above its convex vague mucocutaneous junction and turned down with vermilion lining flap.

Prolabium freed from premaxilla.

Lateral fullbodied vermilion paring flaps retain mucocutaneous junction ridge to accentuate the new cupid’s bow.
Mucosa and Muscle Joined Behind the Prolabium

Mucosa of lateral lip elements sutured to each other in the midline.

Then muscles sutured together firmly!

Midvertical incision in prolabium to-dermis made from behind.

Dimple stitch placed.

If columella of normal length resect wedges from wide nostril floors.

Lateral vermilion paring flaps carrying "white roll" used to overlap turndown of inferior prolabium vermilion.

Then suture closure after tying dimple stitch.

If columella slightly short keep wide floors for later advancement.
16. **Nasal Demands**

A grating refrain constantly being chanted during final evaluation of every bilateral method that does not take the prolabium primarily and place it bodily into the columella is:

OK, a satisfactory upper lip!
But what about the *short columella*
And the flat *nasal tip*!

Several surgeons in the nineteenth century willingly placed the total prolabium into the columella position, and a few are still doing it in the twentieth century. Yet, for the majority, it was all they could do to get the lip together even with the prolabium as a central assistant. Several orthopedic-oriented surgeons, like Denis Browne and LeMesurier, while making important contributions to the lip surgery, admitted quite frankly that the nose was out of their realm and either accepted the nasal discrepancy or abdicated to the plastic surgeon. Thus when the columella needs are ignored from the moment of the first surgery, the nasal tip goes down in defeat in its struggle with the lip for the prolabium. Obviously, the answer is *compromise*.

**SOLOMON’S SUGGESTION**

As it says in the Old Testament, I Kings 3:16, two harlots came and stood before the king. Each had had a child. One had inadvertently smothered hers during sleep but, upon discovering her dead child, exchanged it for the live one in the night. The next morning at breast feeding, the other woman realized that
her child had been replaced by the dead one. Each woman insisted the living child was hers. Finally their argument was brought before King Solomon.

24 And the king said, Bring me a sword. And they brought a sword before the king.
25 And the king said, Divide the living child in two, and give half to the one, and half to the other.
26 Then spake the woman whose the living child was unto the king, for her bowels yearned upon her son, and she said, O my lord, give her the living child, and in no wise slay it. But the other said, Let it be neither mine nor thine, but divide it.
27 Then the king answered and said, Give her the living child, and in no wise slay it: she is the mother thereof.
28 And all Israel heard of the judgment which the king had judged; and they feared the king: for they saw that the wisdom of God was in him, to do judgment.

The prolabium dangles like the cherished living babe, claimed vigorously by the nose and just as vehemently coveted by the lip. As we have seen, through the centuries, some surgeons with compassion have cut it free with their scalpels to go into the nose while others with equal compassion have pared it to go into the lip. I believe, cruelly calculating as it may seem, that King Solomon's original suggestion to divide "the child" is actually the wisest! Compassion has no place here for in actual fact, if wisely divided, the prolabium can serve the nose and serve the lip with benefit to both and without sacrifice to either.

PROLABIAL SHARING

Surgeons have designed various ways for sharing the prolabium between the lip and the nose. Some are better than others. The most common is primary insertion of the prolabium into the lip and then, as a delayed primary procedure, taking part of it for the columella in order to release the depressed nasal tip.

STEALING FROM THE CENTER

In 1833 Gensoul used a vertical V-Y advancement out of the upper lip into the columella to increase the columella length.
From present-day experience we know that this could give only a moderate but inadequate release of a truly depressed nasal tip, but it was a vital, if short, step in the right direction.

This type of procedure tended to tighten the lip from side to side but, in addition, caused vertical lengthening which was particularly unattractive. Exploiting the same principle by adding transverse lateral wings to the vertical flap, Blair, with his trefoil plan, lengthened the columella but shortened the vertical length of the lip at the same time.

Then, in 1941, more than a hundred years after Gensoul proposed this principle, Brown and McDowell embellished it by reducing the trefoil to a fleur-de-lis. Six years later, Brown, McDowell and Byar's comments were of interest:

These children who are born with a total double cleft and almost no columella will frequently require secondary elongation of the latter so that this may be considered standard in this type of patient. Elongation is achieved for the columella by advancing a flap from the upper lip into it. The small cut in the septum out near the tip is usually necessary to get the tip forward and is filled in with small darts on the sides of the flap which come from the nostril floors. The defect in the lip is closed without suturing it to the new columella.

Of even greater interest was the comment:

Further elevation of the nose may be obtained when desirable, by an "L-shaped" cartilage transplant.

A schedule was suggested, by a case shown, of lip closure during the first days of life, columella elongation at about three and a half years of age and preserved L-shaped cartilage transplant inserted at age six. This confirms what the fleur-de-lis design intimates: Often there is not enough tissue supplied to lengthen the columella sufficiently to raise the nasal tip to normal. Then too, as with most columella lengthening procedures, additional support with a cartilage graft is often indicated.

The greatest disadvantage of all these columella lengthening procedures from the center of the lip was that a *third vertical scar* was added to the two scars already present.
In 1956–1957 I designed a secondary forked flap for columella lengthening which was shaped like an inverted V and split like a serpent’s fangs. The flaps incorporated the bilateral lip scars and any prolabium not needed and were taken deep enough to give body to the columella construction. These flaps which were continuous with the nasal tip, were cut out of the lip. Then with the aid of a membranous septal incision carried up over the tip, the forks were folded together and slid up along the septum. They were sutured to each other and then to their new and exalted position on the septum. The midline seam in the columella was unnoticeable. Actually, the two flaps mold into a columella with greater facility than does one larger flap, which tends to resist being forced into a hemi-column. The distal extremities of the forked flap are splayed laterally as columella base flowing into the nasal floor as nostril sill. Closure of the donor area with the aid of alar base incisions is similar to a rotation-advancement action. The forked flap cured a few ills. It afforded:

1. Release of depressed nasal tip.
2. Lengthening of the short columella.
3. Reduction of an unattractively wide prolabium to more natural proportions.
4. Revision of bilateral lip scars.
5. Reduction of the flaring alar bases.

Although the forked flap was carried out originally as a secondary procedure, its value as a delayed primary procedure was soon to become evident.
DELAYED PRIMARY FORKED FLAP

It seemed logical that if the forked flap was effective secondarily, it should be called into action sooner. In fact, it was predicted in 1958:

In severe bilateral clefts, when the columella is extremely short but the prolabium of reasonable size, a modified forked flap may be used primarily.

FIRST CASE

In 1959 the Second International Congress of Plastic Surgery met in London amidst great and colorful pomp and ceremony at the Royal College of Surgeons and at Guildhall. During this meeting and subsequently in the 1960 Transactions of the International Society it was my privilege to present the design diagrams and the early result of a 1958 case in which the rotation-advancement method had the forked flap added in the third stage at five months of age to give a delayed primary columella lengthening.

In the first stage, at two months, lateral vermilion flaps were used to overlap the turndown of vermilion from the prolabium to create a full-bodied cupid’s bow. This procedure also brought in blood supply to the inferior edge of the prolabium in preparation for a delayed forked flap. In this case the premaxilla was inset at the same time into the alveolar arch, but as there was no palate cleft the problem was unusual. This was one of the first examples of early adhesion and, of course, served to mold the position of the premaxilla in the arch. At five months of age the delayed forked flap was elevated and advanced into the columella with release of the nasal tip.

The specific details of this initial case are interesting. The patient was born with a bilateral complete cleft of the lip and alveolus (primary palate) with projection of the premaxilla but
no cleft of the hard or soft palate and almost no columella at all.

On November 5, 1958, at about two months of age the mucoperiosteum of the area in front of the vomer swelling was split and the "overgrowth" was rongeured away. The mucoperiosteum of the cleft edges and premaxilla was dissected and approximated with sutures so that, when the premaxilla was pushed back into the notch in the alveolus and wired, union could follow. The lateral vermilion flaps were used to overlap an inferior prolabium vermilion flap to create a cupid's bow and bring in blood supply to the prolabium for subsequent surgery. This was also an early type of preliminary adhesion.

My concern for the blood supply of the forked flap caused me to diagram the delay incisions on the prolabium and cut them two months after the initial surgery. In the first few cases the forked flap was used even before the cleft edges had actually been approximated. Thus the amount of tissue available was reduced, of course, as the scars of union were not present to contribute to the bulk of the forks. Two weeks later, on February 3, 1959, the delayed forked flap was cut from the lip and with the aid of a membranous septal incision was advanced along the septum elevating the nasal tip and creating a columella. The lateral lip

2 weeks postoperative
elements were brought together tip to tip and then sutured in layers to the sides of the remaining prolabium.

The last sentence of my operative note is of interest and turned out to be a prophecy:

The difficulty here was focused on the five points closure where the two prongs of the fork, the two tips of the advancement flaps and the upper point of the prolabium all come together. Time alone will tell.

Four months postoperatively the scars at the five points were unsatisfactory, but as the months passed the scars improved. Nevertheless, this is a disadvantage in the original design and only years later was modified.

Sporadic minor scar revisions and lip shortening produced as reasonable a lip as can be achieved without joining the muscles across the cleft. The early design of the staged primary columella lengthening marked the ends of the forked flap pointed and thus too short for the total need. The immediate result was promising, and over the years the gain had been maintained and the growth of the nose benefited by the early tip release. Then in 1970 editor Frank McDowell requested proof of the value of early columella lengthening to justify pursuit of this principle in my Plastic and Reconstructive Surgery article "Closure of Bilateral Cleft Lip and Elongation of the Columella by Two Operations in Infancy" and a 12-year follow-up was published.
Finally, on July 5, 1972, at age 14, this outstanding young man had a slight columella lengthening with advancement of his alar bases and nostril floors in a V-Y fashion. A subcutaneous flap was carved from the center of his prolabium to create a hollow and turned down to give more fullness to his tubercle.

Another aspect of this case of particular interest to dentists and surgeons is the 14-year follow-up of the upper dental arch. At age two months the projecting premaxilla had its edges freshened, anterior "overgrowth" of the vomer resected, pushback and wiring of the premaxilla into the alveolar notch. Today the teeth are excellent and in reasonable occlusion and growth seems to be progressing normally.

Two years later, at age 16, scar revision, lip shortening, muscle approximation, nasal tip tailoring and columella bolstering finally achieved correct labial and nasal proportions. When the scars have healed and softened, the appearance and function should be within normal limits.
SIMILAR APPROACH IN BILATERAL INCOMPLETE CLEFTS

This patient was born with bilateral incomplete clefts of the lip, short columella and a cleft of the hard and soft palate posterior to the incisive foramen. On June 7, 1960, at three and a half months of age, lateral vermilion flaps were used to overlap the turndown of inferior prolabium vermilion, but the freshened edges of the lateral lip elements were sutured to the freshened sides of the prolabium in this first stage.

Six weeks later, on July 19, 1960, at five months of age, a forked flap was taken out of the lip incorporating portions of the prolabium, lateral lip and the joining scars. These flaps were advanced along the septum to form an adequate columella and simultaneously release the depressed nasal tip.
On February 22, 1962, at two years of age, scar revision was undertaken, prolabium skin undermined, subcutaneous tissue removed and a through-and-through suture tied over the bolus to create a dimple in the philtrum.

At 16 years of age minor lip scar revision and corrective rhinoplasty were carried out. Alar cartilages were reduced, bridge
straightened, septum shortened, alar bases denuded and advanced to each other, submucous resection to improve airway and septal cartilage inserted into the columella for nasal tip lift and definition. It was exciting to be completing a case which had no columella and had a forked flap release at 5 months of age!

A LATE START

Of course, it is easier when the surgeon gets the case from the beginning. Here is an example of starting late. The patient was born with bilateral cleft lip and palate with protruding premaxilla which was closed at one month on one side and two weeks later on the other. The present surgeon first saw the patient at six months, with lateral elements attached to the sides of the prolabium, the prolabium vermilion intact, the columella absent and the premaxilla protruding. What to do now?
On August 8, 1959, the premaxilla was still prominent so Gillies' reduction was used—anterior plate and tooth buds of the premaxilla were removed and the posterior plate was maintained. A forked flap was incised for a surgical delay and later advanced into the columella.

On August 7, 1969, important lip revisions were done. The width of the prolabium was reduced and in the process "white roll" flaps became available to be introduced between skin and vermilion along the entire lower border of the prolabium. The columella was revised.

A LATE AND UNUSUAL PROBLEM

A two-year-old bilateral cleft lip and palate patient had, from the vague history, had both lip clefts approximated and subsequently the palate closed. A secondary LeMesurier procedure had been done on the right and the patient discharged with sutures in
place. As he proved later with me, this patient was rambunctious and proceeded to strike his lip, with total wound disruption. The other surgeon was so upset that somehow I inherited the problem. On April 2, 1965, the child presented an open wound with eschar, shortness of the columella and a wobbly premaxilla ununited on the left and projecting in front of the maxilla. The patient was left to heal his wound, the process taking about three weeks, and in this interim he managed to lacerate his nose, requiring a suture for hemostasis!

During the next 18 months no surgery was done, but William Silver continued orthodontic care. Then a forked flap which had long been in his future, as marked, was advanced into the columella.
It was planned that at age 16 years a septal cartilage strut would be inserted to support the fork. When the patient was seen again at 12 years, as he expressed concern about his columella retraction and airway obstruction, a modified submucous resection of the deviated septal cartilage supplied a strut. This was fashioned to the shape of a Bowie knife as suggested by Dibbell and inserted for columella correction and tip support. A subcutaneous flap cut from the center of the prolabium and based superiorly was split, and the prongs were advanced into upper deficiencies in the lateral lip elements.

Final revisions including a corrective rhinoplasty will be postponed until the patient is 16 years of age.
THE LATERAL FLAP MODIFICATIONS

Trauner

The principle of transposing a flap taken along the vertical axis of the cleft edge of the lateral lip element into a straight transverse releasing incision at the base of the columella was described as a secondary procedure for unilateral cleft deformities by Richard Trauner of Graz, Austria. He first presented this in Stockholm in 1955 at the same International Congress at which the rotation-advancement principle was proposed.

Then in 1967 at the International Congress in Rome, Richard Trauner with his son Martin adapted his unilateral plan to bilateral lip closure in two stages. This approach was a combination of the method of Veau in the lower portion and what the Trauners termed a Z-plasty in the upper portion. Actually they utilized two vertical flaps from the sides of the lateral elements based on the alar bases. These flaps were transposed tip to tip into a releasing incision across the base of the columella and did succeed in rotating and medially advancing the alar bases.
Wynn

In 1960 Sidney Wynn of Milwaukee Children’s Hospital adopted a procedure which is a cross between the Trauner flap and the pure rotation-advancement. Actually he modified the advancement part of the rotation-advancement principle by cutting a vertical flap off the edge of the lateral element with its base above, as Trauner did, and transposing it into a high rotation release. Wynn applied this approach to bilateral clefts.

For Converse’s 1964 book Cronin chose a case from Wynn’s original 1960 publication and accompanied it with this comment:

Example of lip repaired by Wynn. Note that the prolabium vermilion is a little thin compared with the lateral vermilion. The columella will require lengthening for optimum appearance.

In 1974 Wynn forwarded this series of photos as his example
of one of his bilateral flap technique cases. The scars, however, appear to interdigitate far too low to represent what is generally considered a Wynn-type closure.

The irregularity of the preserved prolabium vermilion confirms a point constantly being made, and the slight central whistling deformity is consistent with Cronin's observation. The columella, which seemed somewhat lengthened at five years, reveals less adequacy at 20 years with snubbing of the nasal tip. The sparse hair growth on the prolabium as compared to the lateral lip elements is of interest. This is, however, quite a good result considering the severity of the original deformity.

Wynn's method has been mentioned in this section in spite of its lack of truly effective columella lengthening because it is basically similar to other designs transposing vertical flaps horizontally somewhere beneath the columella base.

THE MEDIAL FLAP MODIFICATIONS

Marcks
In 1957 Kerwin Marcks, with Trevaskis and Payne of Pennsylvania, designed a secondary procedure taking two vertical flaps from the prolabium based superiority on the sides of the columella. These flaps were transposed zigzag on top of each other into an incision transecting the columella from its join with the lip. Only a moderate lengthening was possible.

Skoog
In 1965 Tord Skoog of Uppsala carefully incorporated a variety of methods into a bilateral Swedish smorgasbord. He had already combined the high incision of the rotation-advancement with the "lowly" incision of Tennison in his unilateral cases. Now he added a vertical prolabial flap to be taken from a position similar to that of the early forked flap, but he transposed it into a transverse columella base incision identical to that described by
Marcks. Skoog proposed that all this be done for one side at three months.

Three months later the identical maneuvers are repeated on the opposite side.

It seems that in spite of Skoog’s masterful precision there are several disadvantages in principle to this general plan. First, the design is too complicated for the dividends gained. Second, the lengthening of the prolabium with double interdigitation is more than likely to produce an upper lip that is too long in the vertical dimension of its sides but relatively shorter in the center with even a possible whistling deformity. Third, the amount of possible columella lengthening is limited, for two reasons: because the greatest release can be only slightly more than the width of the prolabial flap, which, in itself, is limited; and because elevation of only half of the columella at a time strictly curtails the amount of total effective release. Fourth, flaps crisscrossing transversely at the base of the columella are not set in natural lines, and any lumpiness in these “trapdoors” could be quite eye-catching. Fifth, preservation of the prolabial vermilion in a visible position has additional disadvantages.
Onizuka

In recent years the Japanese surgeons, facing vast numbers of clefts, have been extremely productive in this field, appearing in the world literature more and more. One of the most energetic of these surgeons is Takuya Onizuka of Tokyo. In fact, a Japanese rendition of the simultaneous correction of the lip and nose was proposed by Onizuka in 1968. He advocated the rotation-advancement in bilateral clefts but indicated preference for the Skoog prolabium transposition. The combination is carried out one side at a time, and the amount of columella lengthening is limited again to the sum of one width and one tip of the two crisscrossing flaps. This, however, may be sufficient lengthening in the Oriental nose.

Only partial effectiveness

When the columella deficiency is definite, adequate lengthening can be achieved only if enough tissue is added directly to the columella area. The farther away from the columella the new tissue is placed, the less effect its placement accomplishes. As Gillies used to say:

When in love with the daughter, do not kiss the mother, kiss the daughter!

Thus, five modifications have been developed with only modest columella lengthening. Trauner and Wynn transpose a lateral lip flap into the columella base whereas Marcks, Skoog and Onizuka used a medial prolabium flap for the same purpose. Similar general criticisms are binding for all, in that effective columella lengthening is vague when introduced only at the base and is limited in actual amount when it can be little more than the width of one narrow flap.
Primary Shifting of Nasal Floors and Alae

In 1974 in Seattle, Randall, with D. J. Lynch, advocated for incomplete bilateral clefts with a short columella a membranous septal incision extending bilaterally into the intercartilaginous spaces and a modified Carter-Cronin bilateral alar base advancement utilizing rather than excising the wide nasal floors. The lip clefts were treated by the rotation-advancement method. This is part of their description:

Parallel incisions are used . . . but unlike Cronin, we feel there is no need to go beyond the insertion of the alar rim into the upper part of the lip. Rather, the external incision is extended laterally just beyond the incision for the primary lip repair to allow a satisfactory flap from the medial side to be shifted into place as in the rotation advancement technique. The incisions are carried medially up into the columella, preserving a "V"-shaped piece of skin at the base of the columella along with its underlying fibrous attachment to the nasal spine. This is extremely important if one is to preserve the mobilized lip elements from prolapsing down over the premaxilla.

I have not found this to be a great problem in incomplete clefts but it can happen. What is more likely to happen, even though the columella in incomplete clefts is usually less deficient, is inadequate columella lengthening by this approach. As stated by Randall and Lynch:

Occasionally, the amount of columella reconstruction has been insufficient to place the nasal tip at a level that would appear to be completely normal. In these patients further columellar advancement has been necessary at a later date.
19. The Chances of a Lengthened Columella’s Being Hairy

There are some surgeons who consider the prolabium exclusive property of the lip and deny any justification for its being parceled off to the columella. One of their arguments has been fear of the threat that hair will be transported to the nose from the prolabium. After 25 years of extensive experience at Rooksdown House and Roehampton, both in England, where hair has not been reticent to grow, as exemplified by the mustaches of the Queen’s Guard and the bushes of the Beatles, Bill Holdsworth says quite simply:

Lip skin looks well in the columella and rarely is there trouble from growth of hair.

In 1950 Ferris Smith of Grand Rapids, in typical dogmatic style, stated:

Hair may grow on the elevated philtrum skin, but it is not probable, because this skin belongs to the columella. The author has had one instance in numerous cases.

When the total prolabium is used for mid-prolabium flaps, as first described by Gensoul and modified by Blair, Brown and Veau, there is, of course, a greater chance of carrying hair to the nose. Fortunately the mid-prolabium flaps have been displaced for the most part by side flaps from the prolabium, as described by Skoog and Onizuka, or the forked flap. Let's take a moment to evaluate their hairy possibilities.
A BALD DEFENSE

In the first place, this is not a problem in female bilateral clefts. Furthermore, most male prolabiums do not yield luxuriant hair growth but produce a mere fuzz which proves to be as ineffectual on the lip as inoffensive on the columella.

As pointed out by Summerfield King, the mucocutaneous edge around three-quarters of the prolabium, including a slim portion of the adjacent skin, is hairless. Thus the lateral skin sides of the prolabium for almost the entire amount used in the prongs of a forked flap or other prolabium side flaps are more or less hairless from the beginning.

Whenever an incision is made in a hair-bearing area, the healed scar is hairless, partly because of the injury to adjacent hair follicles and partly because of the lack of hair in any healed scar. Thus when the incisions are made for the forked flap parallel to the sides of the prolabium and almost within the hairless area, these cuts increase the area of hairlessness. Of course, when the forked flap is used in secondary bilateral cleft cases, the scars already present, which are incorporated in the forks, are also hairless.

Indeed it is a brave or lucky hair follicle that survives these odds, and one that is still standing up along the front of the columella is reminiscent of the flag raised by the little group of heroic marines on Iwo Jima. What is more, it can be quite easily destroyed by electrolysis or mowed down by one upward sweep during the morning shave. In other words, the forked flap should never lose by a hair!
20. No Lip Muscle Union and Delaying the Forked Flap for a Year or Years

**Experience** with early columella lengthening with the forked flap as a secondary procedure at three to six months of age had suggested several points:

1. Lengthening the columella benefited the nose.
2. Giving up the forked flap benefited the prolabium.
3. But total division of the prolabium from the columella so early, especially in complete clefts, tended to produce a long lip in vertical dimension.

It raised the question: Is all this early hurry to help the flat nose worth the effort or indeed worthwhile?

There not being an obvious answer, I relaxed a bit in my pressure to correct the nose early.

Here is a small series of cases treated mostly in the early 60’s by a conservative routine. “Straddling the fence” and the premaxilla meant that more radical action was required eventually. The general plan was as follows:

1. **Closure of both sides of the lip cleft was to be done in one stage but without joining the lateral muscles to each other in the midline behind the freed prolabium.** The muscleless prolabium was then at the mercy of the stretching action of the lateral lip musculature. This widened and flattened the prolabium but in some instances did not mold the premaxilla enough.
2. In some cases *vomer resection was necessary to set back the premaxilla*. This was postponed to about four to five years of age.

3. In the absence of early columella lengthening, the columella remained short, dragging the nasal tip flat. Thus a *secondary forked flap in one stage*, usually at about five to six years of age, was planned to incorporate the bilateral lip scars and some of the stretched prolabium. This made reentry into the lip necessary with loss of the lovely lip scars of infancy. The "five points" of the one-stage forked flap at this age did not make such nice scars.

**NO MUSCLE UNION AND FORKED FLAP AT ONE YEAR**

![Images of cases](image)

-B.D. 2-20-60
-F.H. No clefts
-F.T. Uneventful
-O.C.A. None

5-26-60. One-stage bilateral lip closure with lateral vermilion overlap of prolabium vermilion.

1-12-61. Forked flap for columella lengthening.
The patient returned nine years later revealing a philtrum and cupid's bow that was too wide, noticeable skin scars, lack of lip muscle continuity, a flared left ala and a retracted columella with a hooked, bulbous nasal tip.

Some of the surgical procedures which had to be used at age 15 years for secondary correction are now being used in the primary closure to bypass predictable problems.

1. During the bilateral scar revisions the prolabium was reduced to philtrum dimensions.
2. The lateral lip element musculature from each side was
dissected free and advanced into the prolabium to within 2 mm. of its counterpart and held with buried 4-0 Mersilene mattress sutures. This slight modification introduces muscles into the prolabium, but it was hoped that if the vertical center of the prolabium was left intact the bulges of the muscles up to this strip on each side would create the effect of philtrum columns flanking a central philtrum groove. Medial white roll flaps were transposed laterally.

3. The left alar base was cut free with a subcutaneous extension, which was advanced and sutured to the septal base. The right alar base was reduced by wedge resection.

4. The bulbous alar cartilages were reduced.

5. A submucous resection of the obstructing septal cartilage produced struts which were used to improve the contour of the retracted columella.

It is encouraging that, in spite of the late forked flap and late lateral lip muscle advancement toward the midline, by 15 years of age a fine final functional and aesthetic result is possible.
NO MUSCLE UNION AND FORKED FLAP AT SIX YEARS

B.D. 3–20–63
F.H. Father
F.H. Bilateral CLP with projecting pre-maxilla
F.T. Uneventful
O.C.A. None

5–17–63. Balber started spreading device.
6–21–63. Right side approximated to probium with usual inferior vermilion overlap.

Balber’s device

Right side first

7–8–63
8-12-63. Similar procedure on left. S.P.
2-22-66
Palate closed except vomer pre-maxillary component.

7-14-67. Vomer resection 1 cm. and setback.

1-30-68. Bilateral bone grafts to the alveolus.
2-21-69. Forked flap.
At three and a half months the mucosa of the lateral lip elements was brought together and sutured behind the prolabium, which had been freed from its attachments to the premaxilla. The muscles of the lateral lip elements were brought to the sides of the prolabium with two chromic catgut sutures passing through the subcutaneous tissue of the prolabium. In other words, the lateral muscles were not sutured to each other across the cleft. Lateral vermilion flaps were used to overlap the turndown flap of prolabium vermilion.
The projecting premaxilla continued to be a problem. The soft palate was closed with pushback and island flap at 14 months of age. The hard palate was closed at seven years of age, and the following year, on June 3, 1970, a fistula in the hard palate was closed.

At one month the prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae. The
lateral mucosa was sutured together under the prolabium, but the muscles were not joined. The lateral vermilion flaps were used to overlap the turn down of prolabium vermilion.

The forked flap was delayed because of the projecting premaxilla until seven and a half years of age. It is a shame to have to leave a child like this so long.

Reentry into the lip at this age does not get good scars and takes a long time to heal. Lip revision and reduction rhinoplasty are planned at 16 years.
At four and a half months of age, one-stage lip closure was accomplished. Because of excessive protrusion of the premaxilla a "conservative" straight-line closure was obtained on each side with no effort to join the lateral lip mucosa or muscles behind the prolabium. The lateral vermillion flaps were used to overlap the turndown of prolabium vermillion.

At four and a half and later at nine years of age the lip was not too long but the prolabium and certainly the cupid's bow were too broad, the nasal tip was flat, the alar bases were severely spread and the columella was nonexistent.
At 9 years the fork was stored in whisker position. The lateral lip mucosa and muscle elements were united behind the prolabium and dimple stitches placed. Six weeks later, the forked flap was advanced into the columella and the alar bases advanced medially. Time will smooth this result and final minor corrections will be made at 16 years.

MUSCLE UNION AND FORKED FLAP AT SEVEN YEARS

B.D. 3–2–68
F.H. Paternal first cousin with bilateral CLP
F.T. Uneventful
O.C.A. None
At two and a half months of age, one-stage lip closure, without undermining of the lateral lip elements from the maxillae, was used to try the C-W approach. There was a gradual partial separation on the right which after three weeks required approximation. The failure to join the lateral muscles together behind the prolabium and the persistent forward projection of the premaxilla caused a gradual stretching of the prolabium to unnatural breadth. Finally, at five years the premaxilla was set back moderately by resection of a portion of the vomer, and orthodontics was carried out by S. Berkowitz.

Already past school entry age, the patient had a flat nose and wide prolabium which forced secondary action in spite of the fact
that the premaxilla was still a projecting obstacle.

In May 1975 the prolabium was reduced by a forked flap which was banked in whisker position. The lateral muscles were joined together behind the prolabium.

Six months later, the forked flap was advanced into the columella to release the nasal tip, and the alar bases were advanced medially.

As the nasal bridge grows, this over-projection of the tip will be accommodated.

Note: It must be admitted that in this type of case, as the prolabium was small and the premaxilla severely projecting, there may be some justification for postponement of a forked flap and lip muscle union primarily. This allows stretching of the prolabium and setback of the premaxilla if such maneuvers are necessary.
This type of conservatism can restrict progress of principles

As it turned out, this type of "conservative" approach did not join the lateral muscles across the cleft, did not mold the premaxilla as well, allowed the prolabium to be stretched thin and, by postponing columella lengthening with the forked flap, left the nasal tip flat for years. Then when the forked flap finally was taken out of the lip, the resultant "five points" scarring at this age was not as satisfactory and took years to soften. It is hoped that the ultimate results will be quite satisfactory, but the number of operations and the delay in time seemed too much. The exception, of course, is when the prolabium is too small and the premaxilla too projecting. There had to be a better way and the search continued.
FLYING SOUTH

THE paucity of bilateral lip clefts in the Miami area in the latter part of the 50's caused me to look elsewhere for cases. Jamaican Kenneth A. McNeill, F.R.C.S., had qualified in medicine at St. Bartholomew's Hospital, London, and served with Joseph Sankey at the Facio-Maxillary and Plastic Surgery Unit, Barnsley Hall Hospital, Bromsgrove, England, during World War II. After hostilities ended, he had returned to Kingston, Jamaica, and started a voluntary plastic surgery unit. During a visit to Miami he invited me to come to work with him in his Caribbean paradise, setting the bait with a promise of plenty of bilateral cleft cases. At the mere mention of bilateral clefts I began tossing instruments and sutures into a bag and almost beat McNeill back to his island in the sun. Thus, a happy cooperation was begun in 1959 which has lasted over all these years. McNeill is now Minister of Health and is planning a plastic surgery center in Montego Bay with a special section for cleft lip and palate work.

At first I tried the delayed primary forked flap again. The diminutive prolabium of pea size was incorporated in the lip and the lateral vermilion flaps were used to overlap the inferior prolabium vermilion. Then, during my next visit to Kingston several months later, the delayed forked flap was advanced out of the lip into the columella with release of the nasal tip.
Attaching the lateral muscle elements to the sides of the pea-sized prolabium stretched the prolabium so much that in a few months it could quite easily give up a forked flap to the columella and still retain a normal-sized philtrum. Thus, the compromise had been successful as far as apportioning tissues between the lip and the nose was concerned, but the lack of muscle continuity across the cleft left unnatural lateral bulges on either side of an unanimated muscleless prolabium.

Another prolabium was stuck between the muscular lateral lip elements in preparation for a secondary forked flap. This was an example of the just described “conservative” approach—with no primary lip muscle union and a delay of the forked flap for years—that I was using in Miami at the time.
Then it was decided that, to improve the lip appearance and action, muscle continuity across the cleft was necessary. Therefore, on a number of bilateral clefts in Jamaica, I used the Meyer-Schultz-Browne-Glover mucosa and muscle closure behind the prolabium and noted definite improvement in lip function. Because of the lack of stretch in the prolabium, the forked flap had to be postponed five years or more. Under this regimen, the lips in the bilateral clefts in the Caribbean Negro were developing so well that the shortness of the columella, although detracting from the ideal result, still did not quite justify an early secondary forked flap. The lip scars following the primary operation in the infant were so good that enthusiasm for additional surgery of the lip to aid the nose was discouraged.
Furthermore, the Jamaican parents were satisfied and only under duress would they return to the clinic with the child. It was disturbing to have results accepted when they fell short of the possible nasal corrections, and in the Caucasian the discrepancy, of course, was worse.

Then a case using this same approach ended up with a nasal tip so flat that this aspect could no longer be ignored.

Here was the spark that set off the primary forked flap.
IN 1965 I decided to "go for broke." It was at Princess Margaret Hospital, Nassau, and I was preparing to close a bilateral cleft lip with David Maisels of Liverpool assisting. The circumstances were similar in many ways to what had been experienced in Jamaica, and I was prompted to say to Maisels:

David, the prolabium must be getting enough blood supply from the premaxilla. You know how it bleeds profusely when we dissect it free. Let's do a primary forked flap and get the nose right at the same time we close the lip.

We did and it went well.

In 1967 the primary forked flap was published as a possible answer to the search for a bilateral cleft operation which closed the lip, reduced the prolabium and lengthened the columella all at the same time. As the prolabial edges must be freshened for lip closure anyway, there must be logic in this economy:

Rather than discard it, salvage it as a forked flap for the columella.

This approach also offered the advantage of avoiding the subsequent need to go back into the well-healed lip five years later to get tissue for the columella. Then too, it bypassed for the child all those flat-nosed years.

BLOOD SUPPLY

Of course, the main deterrent to the primary forked flap was the question of blood supply. As I wrote in 1967:
At first thought, it seemed the surgeon would be sawing off the very limb he had been sitting on all these years. It is true that in complete bilateral clefts, the main blood supply to the prolabium philtrum comes through the columella and the septum (frontonasal component) in the form of the posterior septal artery and, to a lesser extent, the lateral nasal and terminal branches of the anterior ethmoid vessels.

According to Slaughter, Henry and Berger, cleft specimen dissections usually indicate one well-differentiated vessel on either side of the premaxilla in the region where the incisive foramen should have been. Each of these vessels passes anteriorly and inferiorly into the philtrum and continues medially in an arc to anastomose across the midline in the inferior portion of the philtrum.

No mention is made of a direct blood supply from the premaxilla running forward into the midposterior prolabium. Yet, in surgery, while freeing the prolabium from the premaxilla, one invariably noted a generous bleeding. This to-and-fro vascularity between the prolabium and the premaxilla proved to be adequate to sustain the remaining prolabium even following its complete severance from the nasal tip and septum.

INDICATIONS

The primary forked flap was not advocated in all bilateral clefts. Three pertinent factors determined its plausibility:

1. Position of the premaxilla:

   The primary forked flap operation may not be possible if the premaxilla protrudes severely.

2. Size of the prolabium:

   The width of the prolabium determines whether the flap is possible and the vertical length indicates the amount of columella lengthening available. A large prolabium offers no problem, but it is surprising how small a prolabium can be and still serve the columella and philtrum successfully. For instance, if the prolabium is slightly more than 1 cm. wide, then allowance of 0.25 cm. for the width of each fork of the flap leaves a philtrum a little more than 0.50 cm. wide, which is about normal for an infant. If the
prolabium is truly minute, then mere attachment of the lateral lip elements to the pared sides of the prolabium will soon stretch this central non-muscular component into a reasonable size, one capable of accommodating a delayed forked flap.

3. Columella length:

The actual amount of shortness of the columella is one final consideration. This discrepancy must be measured not only in the actual length in millimeters of the columella but also with an estimate of the patient’s desired final length. The natural flatness of the Negro nose demands less columella length than, for instance, the high-bridged aquiline nose filling the Royal enclosure at Ascot. Some surgeons claim that the flat nasal tip, even without columella lengthening, improves with growth. This has never been impressive to me but early release of a tethered tip, even if not to quite the ideal extent, might give subsequent growth a chance to make up the difference.

In the preparation of *A Primary Forked Flap*, a film for the 1967 International Congress in Rome, a little local color was incorporated. As introduction to the film it was suggested that all participants at future congresses bring scenes from their native lands on the premise that knowledge strengthens bonds of friendship. It was explained to the learned audience that the procedure being described had been executed first in the Bahamas and later in Miami and Jamaica, justifying the film’s opening with a skiing scene in tropic waters scored with a background of calypso music. One frame from the end of this short clip combined my Texas roping with Florida slalom skiing on Biscayne Bay. Ron Pigott, who did these drawings for the film, was acknowledged when he also appeared for a short ski run.

The Pigott sketches portrayed a forked flap with its base on the short columella marked on the lateral sides of the prolabium with preservation of enough prolabium in the center to act as a philtrum. With the aid of a membranous septal incision carried over the septal tip and into the vestibule a short distance bilaterally, the forked flap was elevated and its forks were sutured together. It was gently tubed onto itself in its upper portion while the lower portion was left open to be sutured to the membranous septum. The lateral lip elements were dissected
widely off of the maxilla, and the freeing was extended by carrying the incisions up into the vestibule bilaterally. Circumalar incisions to the extent specifically required divided the alar base from the lip elements. The lateral edges of the cleft were freshened by turning down full-bodied vermilion flaps. The prolabium vermilion was turned down also. The key or cliff-hanger stitch picked up the points of the lateral lip elements, the periosteum of the premaxilla at the nasal spine and the superior tip of the prolabium. This suture brought the five points together but reduced tension on the prolabium. The alar base flaps were sutured to the sides of the septal base, reducing the alar flare and constructing the nostril sill. The tips of the forked flaps were sutured lightly to the lip flaps and the alar base flaps. The lateral mucosal flaps overlapped the turndown flap of prolabium vermilion to give a full-bodied free border and a suggestion of a cupid’s bow.

THE AFTERMATH

Evidently, complete division of the prolabium from the nose turned it free to be tugged, stretched and shifted by the strong lateral lip muscle elements. In the earlier cases, the forked flap too was being dragged partially out of the columella back down into the lip. The key nylon suture, which later was used to tack the lip elements to the periosteum of the premaxilla at the nasal spine, was an attempt to prevent lip lengthening and columella drag-back. It was only partially successful.

Here is a case with adequate prolabium, short columella and extremely flaring alae. A primary forked flap reduced the wide prolabium and gave some length to the columella.
The *early* total division of the lip from the nose and the lack of muscle continuity across the cleft allowed the prolabium to be stretched, the lip lengthened vertically and the forked flap pulled partially back into the lip.

Secondary revisions shortened the lip, reduced the alar flare and even tried for a philtrum hollow.

**NOT IDEAL FOR GENERAL USE**

A small series of primary forked flaps was done. The blood supply from the premaxilla proved adequate although occasionally the prolabium would turn slightly blue for a few hours. There was a rumor that one or two surgeons had lost a prolabium; if true, this tragedy was probably due to an incorrect key stitch and the application of too much tension to the prolabium.

In complete clefts the results immediately after surgery were impressive, but within a few months, in some, there was too much vertical lip length.
Take this Jamaican case, for instance. The prolabium was short but wide enough, the columella nonexistent and the premaxilla moderately protuberant. A primary forked flap redistributed tissue in what seemed quite reasonable nasal and labial proportions.

Then in time the early division of lip and nose and the lack of muscle continuity allowed the lip to spread and stretch and the forked flap to pull wide and back into the lip.

A high transverse excision of lip and readvancement of the columella and alae achieved a shorter lip and a better columella and improved the position of the alae.
Again in time some of this gain was lost, but the tissues are now well proportioned and can be improved satisfactorily prior to school age.

A primary forked flap in this complete bilateral cleft went well during the initial surgery. There was even the creation of a philtrum dimple.

Then gradually the forked flap pulled back into the lip and the lip lengthened. This defect was corrected by readvancement of the forked flap into the nose and shortening of the lip, preserving the philtrum dimple.
In incomplete bilateral clefts there seemed to be less consistency as to what was going to happen postoperatively. This severe incomplete cleft developed a long lip, but the forked flap remained up in the columella almost too much for the child's age and nasal development.

On the other hand, in this incomplete bilateral cleft, the lip maintained reasonable length but the forked flap tended to drift down out of the columella back into the lip. Revision is in order at school age.
STRUTTING THE FORK

It is becoming more and more apparent that with the absence of adequate septal projection and the flattening and spread of the alar cartilages in bilateral clefts, even after forked flap release of the depressed nasal tip, the cartilages are not sufficient as skeletal structures to hold up what has been lifted. Primary homologous (child) and autogenous (after 16 years) septal cartilage struts are indicated at the time the forked flap is formed to prevent it from slipping back into the lip.

A SERENDIPITOUS Dimple

In another incomplete bilateral cleft, the primary forked flap produced a result with another unexpected but greatly appreciated philtrum dimple and flanking eminences.
The remaining philtrum-shaped piece of prolabium was smaller than usual and, of course, maintained its attachment to a premaxilla that was not unduly protuberant. The larger muscular lateral lip elements were joined to the sides of this diminutive prolabium and also were joined to each other above the upper pole of the philtrum. It was an incomplete bilateral cleft and great tension was not involved. This created a modified three-fourths circle of muscle around a tiny tethered mid-philtrum which, in cooperation or out of desperation, inverted into a dimple and persisted as such.

Such serendipity led to the conjecture that if the upper labial sulcus is late in its formation prolonged adherence of the prolabium to the premaxilla could be a factor in dimple formation. Monie was asked to review his bilateral cleft specimens to determine the time of upper labial sulcus formation and see whether the prolabium-philtrum is still totally tethered to the premaxilla while the groove and eminences are being formed. Unfortunately, Monie’s specimens were cut on the transverse plane with a view of the philtrum but not of the sulcus.

In retrospect, this specific occurrence was accounted for in my 1967 primary forked flap article by a cause-and-effect study:

The remaining philtrum-shaped piece of prolabium was smaller than usual and, of course, maintained its attachment to a premaxilla that was not unduly protuberant. The larger muscular lateral lip elements were joined to the sides of this diminutive prolabium and also were joined to each other above the upper pole of the philtrum. It was an incomplete bilateral cleft and great tension was not involved. This created a modified three-fourths circle of muscle around a tiny tethered mid-philtrum which, in cooperation or out of desperation, inverted into a dimple and persisted as such.

Such serendipity led to the conjecture that if the upper labial sulcus is late in its formation prolonged adherence of the prolabium to the premaxilla could be a factor in dimple formation. Monie was asked to review his bilateral cleft specimens to determine the time of upper labial sulcus formation and see whether the prolabium-philtrum is still totally tethered to the premaxilla while the groove and eminences are being formed. Unfortunately, Monie’s specimens were cut on the transverse plane with a view of the philtrum but not of the sulcus.

OTHER SURGEONS DARE TO USE THE PRIMARY FORK

In 1967, at the International Congress in Rome, Maisels and Littlewood of Liverpool presented their experiences with the
primary forked flap. They expressed approval of the natural shield-shaped philtrum in preference to the previous square patch and commented on the simplicity of the simultaneous lip closure and columella lengthening. They warned, however:

It is not possible to repair the anterior palate at the same time as the primary forked flap. In one case when an overambitious attempt was made at anterior palatal repair, the premaxilla was circumferentially denuded of soft tissue. It is of interest to note that the vomerine intra-osseous blood supply was sufficient to ensure survival of all the premaxilla apart from incomplete loss of the skin of the prolabium.

In 1972 the results and feelings of several surgeons on the primary forked flap were brought to my attention. Gracious Shojiro Takahashi of the Tokyo Dental School wrote:

I reported my experience in bilateral cleft lip repair by using of Millard's forked flap method at the general meeting of the Japanese Society of Oral Surgeons on October 1st 1971 in Tokyo. I successfully repaired a bilateral complete cleft lip (14 year old girl) by a primary forked flap in Indonesia in January 1970.

He included photos of the case.

Takahashi prefers to use an adhesion prior to the forked flap but did this primary fork as it was a "one chance" case in a foreign land.

When at home and at leisure Takahashi first creates what he refers to as a preliminary Randall adhesion. Its sole purpose seems
to be to restrain the premaxilla much as the rubber band does. Then at a second stage he does a forked flap which is identical to and just as radical as my primary forked flap procedure. He forwarded me photographs of one of his cases which showed the original bilateral cleft condition, the situation one month after the adhesion, the marking of the forked flap and the immediate postoperative result.

Also included were the result at 10 days.
In countries where there are many clefts and relatively few surgeons, a one-stage procedure offers appreciable dividends. Whereas in the African or even the Oriental the short columella is of less importance, in certain East Indians with high nasal profiles the proud columella is more demanding.

S. S. Sethi of Maulana Azad Medical College, New Delhi, India, in 1970 and in 1973 approved the one-stage primary forked flap at six months of age when the premaxilla is not protruding and the prolabium is not very small. His only modification from my original description was preservation of slightly more vermilion with the mucocutaneous junction line of the prolabium. Another interesting aspect is Sethi's use of this principle in the adult. As he wrote for the Copenhagen Congress:

In the grown up unoperated cases, the circumalar skin excisions help the moving in of the lateral lip triangular flaps. These triangular flaps meet together proximal to the tip of the prolabium island. The prolabium sinks down in line with the vermilion of the lateral lip elements, to form a nice cupid's bow and does away with any notching in the midline. This procedure forms a broad and protruding lip, a columella, a philtrum and narrow nostrils. . . . The only snag in this procedure is the delayed healing at the base of the columella where the tips of the too many flaps meet.
A suggestion for Sethi would be to turn the toes of the fork outward to join the alar bases lateral to the “five points” for improved healing.

Also in 1972 Don Kapetansky of Southfield, Michigan, forwarded to me early results of his execution of a primary forked flap.

In the same year, from the Permanente Medical Group in Oakland, California, George Scrimshaw wrote:

In bilateral clefts, I prefer the one-stage forked flap advancement in spite of some drawbacks.

James Hendrix, Jr. of the University of Tennessee, Memphis, at the Cleft Palate Symposium at Duke in 1973, presented a complete bilateral cleft lip and palate which had an early premaxillary setback by vomer resection. This was followed in 10 weeks by a primary forked flap for columella lengthening at the time of lip closure. The result shown at one year was promising.

**PRIMARY FORK PLUS ADHESION**

Peter Randall, influenced by Pennsylvania youngsters’ constant first request, “Please fix my flat nose,” has been experimenting with early forked flaps in complete bilateral lips. In 1971 Randall was “lengthening” the columella at the time of the definitive lip surgery but with minimal effectiveness as judged by the photographs. By 1972 he indicated his change by shifting the forked flap into the columella during the primary adhesion procedure. He wrote:

In bilateral clefts only one side is done at a time. At the time of the initial adhesion, a forked flap lengthening of the columella has worked well in a number of cases.

By the 1973 Copenhagen Congress, Randall, with Arthur Brown, elaborated:
In severe bilateral complete clefts of the lip the steps in repair have been first a forked flap reconstruction of the columella and a unilateral lip adhesion at the same operation. Secondly, a lip adhesion on the opposite side sometimes in association with closure of the soft palate. These two operations are usually carried out at three and six months of age. . . . The early reconstruction of the columella has led to marked improvement in the position and growth of the nasal tip. It uses tissue which is otherwise likely to be scarred in many of the procedures currently used for bilateral lip repair. The lip adhesion has been a considerable help as a gentle dynamic force for repositioning the protruding premaxilla.

In 1974 in Seattle, Randall, with Dennis Lynch, expressed his approval of placing nasal tissues into more normal position to facilitate growth rather than worrying about whether early scars might discourage normal growth. Peter Randall and I had a chance to discuss personally and at length what he has been doing. In his first case in 1965, he shifted one fork at a time and brought about what he referred to as "an unnecessary amount of distortion." It could be added, "and a limited amount of columella lengthening." Since then he has carried out 20 more so-called primary forked flaps and has varied his approach using a different timing of procedures in each group of two or three cases. In one he did the standard primary forked flap which I described. His other combinations included a one-sided primary forked flap with definitive lip closure which ended in a crooked result, as might be expected. In still others he did a lip adhesion, then a primary forked flap and finally, in the third stage, a definitive lip closure. In some he did a primary forked flap and a lip adhesion on both sides. The combination he seems to favor is a primary forked flap accompanied by a lip adhesion on only one side. He emphasized maintaining the ligamentous attachments of the prolabium by extending the V-shaped incision at the base of the columella farther up into the nasal tip to preserve for the prolabium the columella-lip angle with "its underlying fibrous attachment to the nasal spine." When the premaxilla is protruding, Randall closes the raw donor area of the forked flap on one side with sutures. On the other side he creates a unilateral adhesion by turning the undisturbed vermilion from the side of
the prolabium under a mucosal flap lifted from the cleft edge of the lateral lip element.

Sometimes a buried fixation suture at this point can help. I predict from experience that this will not prevent down-drag of the lip with vertical lengthening, and even Randall already admits both lip lengthening and obliteration of the columella-labium angle in certain cases. In fact, in three he has found both loss of the columella-lip angle and lip elongation and in another two just lip lengthening, for a total of five. In my series of primary forked flaps, of course, not all lips were pulled long and a buried fixation suture was used. When it did happen, however, this sequela daunted my compulsion for early release of the lip from the nose.

Randall candidly enumerated the other secondary deformities occurring, but with so many varieties it is impossible to tell which caused what. Besides the 10 wide prolabiums and the five long lips already discussed, three had to have secondary columella
lengthening and another four deserve it. Two columnellas were atrophic, two were bulky, five were retracted and one was hanging. Only two, in fact, had none of the defects noted, but remember, the nasal tip was more or less up and this is a nasal advance.

A TWO-STAGE PRIMARY FORKED FLAP

Australian Harold McComb of West Perth in 1975 presented his modification of the primary forked flap. His first step is presurgical orthodontic correction of the "displaced segments of the maxillary arch" stabilized by a sucking plate. At 6 weeks of age, the primary forked flap is advanced into the columella and sits on top of the remaining prolabium to gain a length of 5 mm. At 3 months of age, through upper buccal sulci incisions, all the skin of the nose is elevated, particularly over the alar cartilages. Silk sutures through the intercrural angles of the alar cartilages are brought out at the nasion and tied to correct the downward rotation of the alar cartilages and elevate the nostril margins and lining. This adjunct promises an interesting lift.

The remaining prolabium is interposed between the lateral lip elements without muscle-to-muscle approximation, while retaining its old vermilion.

In fact, the nasal part of this procedure is superior to the labial part. Yet, the join of the columella to the lip shows an abrupt demarcation line, and further, this limited length of forked flap
does not provide sufficient release to the snubbed nasal tip. As noted by McComb, his results are too new for true evaluation.

**Forking the Entire Prolabium Primarily**

In 1973 Ivo Pitanguy of Rio in his own clinic publication, *Boletin de Cirurgia Plastica*, with Luiz Carlos Garcia, Guido Gandarillas Velarde and Gilson Dotto, adapted his 1967 secondary use of the total prolabium as a forked flap to create a columella in what is actually a primary forked flap without leaving any prolabium to construct the central philtrum. He slides the split prolabium partially into the columella as a forked flap and lets the tips splay, as I have suggested repeatedly, to form the nostril sills. He also discards circumalar crescent excisions, evidently to facilitate alar base rotation, and then joins the lateral lip elements to each other in the midline with one unnatural, potentially contracting, vertical scar. His justification for this rather radical action concludes:

> By an extensive observation of 164 cases operated by the senior author, we have concluded that the fact of joining the two lateral inner sides at the medial line will permit us to join the muscle fibers of one side to the ones of the opposite side. This avoids the need of suturing the muscle to the prolabium for in reality, it does not bear muscular fibers. Thus, a real functioning muscular band is achieved, which will re-establish the force antagonism, which assumes a vital importance in the face edification, regarding the premaxilla reposition.

In my opinion this modification of the forked flap is no more functional and is certainly less aesthetic, as is graphically demonstrated in the two cases Pitanguy presented in his clinic bulletin. Although the color photos are vague in focus and angle, it seems that in the more pleasing of the two he has actually preserved the central prolabium for a philtrum, as in the standard primary forked flap. In the second case he used the total prolabium for columella, and consequently the lip and philtrum have suffered for it. The following case of mine is pertinent to this argument.

Although it was encouraging that surgeons were willing to
make valiant efforts to correct the lip and the nose in one stage, the results were not perfect and the hazards and problems were real. Even with the originator's edge I had one case that proved to be such a problem it deserves description in detail.

A DIFFICULT COMPLICATION

On December 12, 1966, at nine days of age, a primary forked flap was cut from the prolabium and advanced along the septum with elevation of the depressed nasal tip. The lateral lip elements were freed widely and sutured to the residual prolabium. The lateral vermillion flaps overlapped prolabium vermillion. The infant had a severely protruding premaxilla and a small prolabium, but closure was still obtained.

Then a mistake was made! A maxillary plate, fitted previously, was inadvertently left out during surgery, and on the first postoperative day an attempt to reinsert the plate caused the lip closure to pull away on one side and eventually to separate on both sides. Emergency resuture was of no avail. The forks on the columella were left in good condition, but the diminutive prolabium was further reduced by its forfeit of the forks. Now, with three raw sides and only the premaxillary blood supply, it gradually shrank and was scarred to oblivion.
Six months later, on June 30, 1967, a Hagerty-Mylin maxillary spreader type of screw plate was pinned in Miami by William Mylin of Charleston, South Carolina. About a year later, on July 7, 1968, resection of 1 cm. of vomer allowed setback of the premaxilla so that the lateral lip elements could be approximated to each other. On October 8, 1969, the soft palate was approximated, and on July 14, 1971, the anterior hard palate cleft was closed with a vomerine flap. Iliac cancellous bone chips packed between the alveolar bone gaps and struts were overlaid across the clefts.

Four years after lip closure, on July 5, 1972, the midline lip scar was excised. A long, 2.25 cm. Abbe flap was transposed into the lip defect and trimmed at its distal end to blend into the columella base. Seven months later a pharyngeal flap was attached to the velum. As the alar bases were still too wide, they were corrected with a general technique being used primarily in unilateral and bilateral clefts routinely now.

The alar bases were freed and divided into two flaps each: one anterior to advance to the columella base and narrow the nostrils; one posterior in nostril sill, denuded of epidermis, to join its mate from the opposite side with a Mersilene suture through a tunnel behind the columella to add bulk and to secure the alar advance.
Maytag Fellow Arnold Arem from Peacock's Tucson unit sketched the above records of the procedure.

After several years of experience with the primary forked flap, it finally occurred to me that this "all-in-one" method, although available for "one-shot" cases, was probably too hazardous for general use. There had been rumors of prolabial loss elsewhere, whatever the cause, but then I myself watched one shrivel and scar. Yet the cardinal disadvantage of the primary forked flap procedure was the impossibility of including the Meyer-Schultz-Browne-Glover principle of joining the lateral mucosa and muscle behind the prolabium to form a functioning lip with an upper labial sulcus.

ANOTHER ONE-SHOT CLOSURE

Jack Mustarde, a canny Scotsman with a knack for getting the better of the other fellow, spent three years as a P.O.W. and ended up writing a best-seller on his experiences. Gillies' early influence stimulated him to venturous innovations, and one example was his 1971 one-stage rendition of the primary simultaneous lip and nose correction in bilateral clefts. He isolated the prolabium from all of its blood supply except that coming
through the premaxilla but left it its original size. He then cut quadrilateral flaps vertically from the lateral lip elements, which often cannot spare the tissue. These lateral flaps first were transposed in the manner of Trauner across between the prolabium and the released columella base and then were shoved side by side one step further as upside-down forks up into the columella to end head-on under the nasal tip. On paper this maneuver seems to be an improvement over Trauner in that it gets more columella out of the lateral flaps, but again there are some real disadvantages. It faces the hazards my primary forked flap did which finally caused it to be set aside for a better and safer approach. Moreover, the lateral lip muscles cannot be joined together behind the prolabium, no upper labial sulcus is formed and the *early complete* division of the nasal tip from the prolabium is almost certain to result in a lip too long in its vertical dimension.

**HASTE MAKES WASTE**

I think it is fair to conclude that any one-shot procedure that by its rapid execution forces omission of any important aspect has only speed in its favor. If speed is not required, its use is unjustified.
FIRST came full realization that lateral muscle and mucosal union behind the prolabium had too many marks in its favor to be ignored. There was the creation of an upper labial sulcus, excellent muscle function in the lip with less tendency for prolabial spreading and reduction of tension on the skin during closure, resulting in better scars. Yet a personal determination to save the lateral parings of the prolabium as a forked flap for the columella had me searching frantically for a way to set the forked flap aside temporarily. Then I learned of Duffy’s banking maneuver.

Colonel Michael M. Duffy, now chief of plastic surgery at Brooke General Hospital, Fort Sam Houston, builds Kentucky rifles in his spare time and has sailed the East Coast from Nova Scotia to Florida. A constant sailing partner was William C. Meloy, his stepfather and one of the founders of the American Board of Plastic Surgery. Meloy diverted Duffy’s interest in biology research by explaining:

Research on sea urchins is fine but if you discover anything worthwhile you need an M.D. to apply it to man.

and from there to plastic surgery was easy. Duffy joined the regular army for residency training and eventually was stationed at Walter Reed Hospital. Duffy recalls:

This meant I had to sign on for three years of plastic surgery—two at Walter Reed and one with Dr. Brown in St. Louis. The first two under Bill
Tumbusch and Bob Parsons were a relaxed blend of modified Blocker and Brown philosophies. At the end of two years the Army residency was approved to stand on its own and I desperately wanted to avoid carrying Dr. Brown’s brief case for a year.

As it turned out, he remained at Walter Reed through the bulk of the Vietnam reconstruction. An excerpt from his philosophy is enlightening:

I abhor the practice of applying a stereotyped operation to a patient whether it fits or not, and think that all surgery should be innovative and adapted to individual needs, with always the question in mind “how can I do this better?”

In 1970 Duffy described a modification of the Meyer-Schultz-Browne-Glover approach by undermining the prolabium from the premaxilla except at its inferior vermilion attachment. This created a tunnel into which he united the lateral lip elements to obtain muscle closure. In one case he cut the forked flap from the prolabium but “banked” it in the nasal floor for three years, after which he advanced it into the columella. The prolabium tunnel approach seemed unnecessarily complicated, but the principle of banking the forked flap was appealing. From his description, just how he stored the fork was rather vague. In 1971 he published illustrations.

In my first attempts, I let the fork prongs into transverse subalar base incisions “whisker fashion,” much as Duffy’s diagrams indicated; this was the first hop in their flight toward the
nasal tip. The incisions being hidden in the natural nasal creases, they are usually unnoticeable. Then I ran into an unexpected problem. The mucomuscular closure behind the prolabium had been achieved but *not with adequate medial advancement in the upper part of the lip and alar base*. This discrepancy had been passed over during the first stage probably because of preoccupation with the subalar incisions and storage of the fork.

In a month, when the time came to continue the "flight of the fork" and advance it into the columella, I found it somewhat difficult to advance the alar bases from their wide position without compensatory triangular skin excisions at the bases. These excisions facilitated the action but added to the cheek scarring.

This is the case that eventually precipitated an important change for me. An elastic band on the headcap had achieved some premaxillary retraction.

At two and a half months, a one-stage lip closure was done.

1. Prolabium freed from premaxilla and lateral lip elements freed from maxillae.
2. Forked flap pared from prolabium.
3. Mucosa and muscle joined to each other behind the prolabium.
4. Lateral vermilion flaps used to overlap prolabium vermilion.
5. Forked flap banked in subalar incision, whisker fashion.

<table>
<thead>
<tr>
<th>B.D.</th>
<th>10-10-69</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.H.</td>
<td>No clefts</td>
</tr>
<tr>
<td>F.T.</td>
<td>Uneventful</td>
</tr>
<tr>
<td>O.C.A.</td>
<td>None</td>
</tr>
</tbody>
</table>

12-30-69
Lip closure.
Although the lateral mucosa and muscle had been united in the midline, the upper muscle approximation had been timid and the alar bases had not been advanced medially in an attempt to leave a subalar gap in which to store the forks. This allowed subsequent lateral pull to spread the prolabium, broaden the cupid’s bow and leave the alar bases flared. Then, when it came time to shift the forked flap, advancement of the wide alar bases required Burow-Imre-Szymanowski lip-cheek triangular skin excisions with less effective base positioning and more scarring.
The columella is long enough and, although it is too broad and retracted, it can be corrected easily by narrowing and inserting a septal cartilage strut at about 16 years of age. The bow is too wide and will have to be reduced by another type of forked flap based above on the nostril floors and let into a releasing incision in the membranous septum on each side to correct the columella retraction. The cheek scars have finally faded—and so did any enthusiasm for this modification.

It had become obvious that medial advancement of the lateral lip elements and the alar bases to near normal position should be accomplished in the first stage. But in that event prongs of the

*Comment:* Primary advancement of the alar bases with fixation was developed from experience of this case.
fork adequate in length to release the nasal tip would be quite long for a subalar incision unless it curved around the alar base as a handlebar or Hercule Poirot mustache. Another banking process was sought.

THE "PRAYING HANDS" PYRAMIDS

The next attempt, which was popular for a time, banked the forks by suturing them to the alar base flaps, at first end to end. Then the slack was further taken up by continuing their approximation belly to belly with the joined ends projecting like a pair of pyramids.

When it was time for columella lengthening, the prongs of the fork and the alar bases were separated except at their tips, and the resultant long strap was rotated up into the columella bilaterally. This had advantages over the previous approach and was used in a number of cases with reasonable success.

There remained three questions: how to advance the alar bases, how to bank the forks better and when to cash them in to the columella. When the alar base was merely sutured to the fork, no dramatic medial rotation of its flare was possible. Thus it was decided that definite and permanent alar base positioning deserved greater priority than its being a temporary playmate in the forked flap banking game.

JOINING ALAR BASES TIP TO TIP

The alar bases were freed from their lip elements as before, and some correction of the flare was achieved by muscle-to-muscle union in the midline under the prolabium. To increase this action, the tips of the alar base flaps were denuded of epithelium, advanced even more medially and sutured to each other at the nasal spine. The result was indeed impressive alar base positioning, but what to do with the damned forks?
FORKED POLYPS

In one case, they were tubed on themselves and tied together in front of the nose, finally becoming two projectile mounds available for columella construction later. They looked funny and caused questions from parents and friends.

WHISKERS

In the next case, the alar bases were again joined to each other subcutaneously in the midline and the forks partially tubed on themselves and let into the transverse incisions between the lip and alar bases, whisker fashion. This is probably the best method of all.

DECISION TO DELAY FORKS

My second concern was the optimum time for shifting the forked flap into the columella. Although early correction seems ideal, there is no question that total division of attachments between lip and nose, as achieved with a forked flap and other flaps introduced between columella and lip, has a tendency to allow lip elongation. Once the original attachments of the lip to the nasal spine have been severed, the lateral lip muscles seem to pull a vertical length in the lip and drag the tips of the forked flap back into the lip. This seems a more likely event in complete bilateral clefts and may justify a delay of several years in the second stage of the forked flap.

The next modification tried was in the method of columella lengthening. Instead of the usual membranous septal incision for the forked flap advancement, a more superficial dissection was used. In one of the cases in which the forks had been left protruding like horns, these projections were freed and opened and, in continuity with them, the skin of the anterior columella was elevated as a flap based on the nasal tip. Thus the spread medial crus of the alar cartilages was exposed, and all tissue between the cartilages was excised so that they could be sutured together with nylon to lengthen the columella and sharpen the
nasal tip. The forked flap, united two-thirds of its length, was advanced into the columella, and its distal ends were allowed to splay as columella bases to join the alar bases to form the nostril sills. The only advantage of this approach seemed to be that the main attachments of the lip to the nose at the nasal spine were left intact with a possible reduction in the chance of subsequent vertical lip lengthening and columella down-drag. The disadvantages seemed to be less columella lengthening and some danger of inadequate vascularity for the ends of the fork with such a thin columella base.

**ADVANCE ALAR BASES AND STILL BANK WITH "PRAYING HANDS"**

An improvement in the banking procedure makes possible the cinching of the wide nasal base simultaneously with the banking and will be described later in detail. In principle, it splits the alar base flaps into a skin flap D and a subcutaneous pedicle d. The subcutaneous flaps are sutured to each other and to the septum above the nasal spine, effectively reducing the flare of the alae and narrowing the wide nostrils. The alar base skin flap D is left free to approximate the corresponding fork to form a nasal sill pyramid. In fact, these flaps in gentle apposition are symbolic of Albrecht Dürer’s 16th-century *Praying Hands* offering the hope that the banking will be sound, with safe preservation of the deposits immediately available upon withdrawal for columella payment.

**CHOICE OF BANKS**

Of the three banking maneuvers, polyps, "whiskers" and "praying hands," the polyp approach is obsolete. For a time, I favored the "praying hands" method as it cleared the forked flap from the lip completely and joins the prongs to the alar bases for a strap flap advancement. It is, however, responsible for more nasal obstruc-
tion, requires more postoperative care and cleaning and is a little more complicated as regards to maneuvering the flap eventually into the columella because it requires bilateral strap formation and partial opening of the pyramids prior to advancement up along the septum.

The forked flap can be inserted between the lip and the alar bases bilaterally in "whisker" position without difficulty, even after reduction of the alar flare, and retrieved for the columella as easily without lip scarring. It presents less nasal obstruction and requires less care during the weeks, months or years of banking. It has shown the least amount of shrinkage. For these reasons, the "whisker" position has become more popular. It is definitely the banking of choice in out-of-town cases and was used in the first stage of the bilateral cleft case which Simon Fredricks scheduled as a backup for the TV presentation of operations before the American Society of Plastic and Reconstructive Surgeons in Houston in 1974.
Randall and Lynch reported in 1974 after an experience with two complete clefts:

We have not been pleased with these results as the "banked" tissue has tended to melt away.

Since they also reported that 10 of their cases had postoperative prolabiums which were "far too wide," the partial disappearance of the banked forks might be explained by the fact that the forks were cut so slim in the first place.

The astute Ray Broadbent of Salt Lake City’s Primary Children’s Hospital was another of the few who have tried banking
the fork but he too was disappointed with the apparent shrinkage of his flaps. A closer scrutiny of this phenomenon is warranted.

**OSTRICH LOGIC?**

Broadbent and Woolf in 1972 admitted:

The flat nose remains as an unanswered problem in the primary repairs.

They follow the same plan of reducing the width of the prolabium to philtrum dimensions as I have advocated, stating:

The cupid's bow should not be more than 3 mm. from the bottom of its peak on either side.

They then "throw away" the excess, justifying this disregard of principle with

We have found "banking" of small flaps in the floor of the nostril to be of no value.

They do wisely place the excess in the floor of the nose, but spurning its value:

Admittedly, the latter is inadequate tissue for suitable nasal tip elevation but it does give body to the nasal floor.

Of course, this judgment depends directly on the ingenuity of their banking, the size of their flaps and the cover of their raw areas. Studying their fine results suggests that a Mormon thriftiness possibly has restricted prolabium reduction short of normal except in one case with an almost adequate columella. If the prolabium is reduced a bit further to 5 to 6 mm. by paring more generous forks and retaining their vermilion border for extra tissue and cover inside the nose, quite substantial flaps can be salvaged and safely stored for subsequent columella lengthening.

Broadbent was challenged with this solution, and his most recent reaction was:

I must admit you have larger flaps tucked in the nose than I have been putting there, but I have given this procedure up and frankly don't have an answer to elevation of the tip of the nose at the time of primary repair.
Here is a case in point by Broadbent in which the prolabium has been reduced but the columella is short and as the lip is good there is no tissue available for the nose.

Both Broadbent and Woolf go along with my 1970 stand that the scar of infancy is superior, rendering reentry objectionable. They wrote in 1972:

It is our opinion that the best lip scar is the first one produced and the surgeon must arrange the scar pattern with intent not to disturb it.

They face the residual persistent short columella with two procrastinations:

[1] The tissues for correction of the flat nose are, in our opinion, in the dome of the flaring nostril. It remains a challenge for all of us to find the right way to place them satisfactorily into the nasal tip.

But I say it will still require extra skin for the columella lengthening, whatever is done to the tip cartilages.

[2] Timing is unimportant. Those who say that the flat nose deformity gets worse and must be corrected early may rue the day of that early surgery, when the resultant scar limits what they otherwise could accomplish by rhinoplasty.

Shifting sufficient skin into the columella can only facilitate the later rhinoplasty.
PLAY NOW, PAY LATER

To discard valuable portions of prolabium and create “invisible” scars of infancy may produce a lovely lip which can be enjoyed and boasted of temporarily. Eventually one must pay through the nose for this frivolity, for with no stored tissue available and no extra tissue remaining in the lip, the bridge has been burned and the tip of the nose stays down.

Broadbent got in the last word if not the best tip elevation in October 1973 when he wrote as a P.S.:

We’re elevating the nose in bilateral clefts early in infancy with a composite graft from the ear.

Here in the margin is an example by Broadbent and Woolf.

MUSCLE UNION STILL NOT UNIVERSALLY ACCEPTED

At the Cleft Lip and Palate Symposium at Duke University in the spring of 1973, Georgiade, Brauer and Broadbent had each given a 10-minute dissertation on their ideal procedure for management of bilateral cleft lip. Not one of these three giants in the field had approximated the lateral orbicularis oris musculature across the cleft over the premaxilla. The undercurrent of feeling among them seemed to be that such action over a projecting premaxilla called for too much tension.

THE ROOKIE FROM AKRON

During the presentations at Duke, young James A. Lehman of Ohio, trained by Musgrave and having had a Maytag Fellowship in Miami, sat and listened. Later he said:

All of these techniques failed to describe muscle to muscle union and all produced an extremely wide and undesirable prolabium. I decided that I could no longer sit through the old method of correcting these deformities. Waving the muscle banner, I proceeded to tear at the old facade created by these paragons of plastic surgery.

In fact he raised his hand and challenged the panelists:

What about the importance of getting muscle union across the cleft?
There was a short silence. Who the hell was this upstart? As moderator of this panel I encouraged Jim:

That’s the boy, Jim, carry on!

He held his ground with the courage of his convictions. Ray Broadbent led the counterattack:

I do not feel this is important. There is too much tension.

I reminded Ray that we both felt the prolabium should be of philtrum dimensions, which meant moving the lateral muscles at most only another 3 mm. from each side. Then, as they are not sutured to the pitiful little prolabium but to each other, the tension is absorbed between themselves leaving the unharassed prolabium free to rest quietly over the muscles in the center of the lip.

Four months later in Copenhagen I moderated another bilateral cleft lip panel. Georgiade again was the leadoff man and he was followed by other famous surgeons such as M. Perko of Switzerland, G. Pfeifer of West Germany and T. Skoog of Sweden. Not one of these panelists advocated truly joining the muscles across the cleft. Program chairman B. Johanson had requested that the moderator participate, so among other aspects the importance of muscle union was stressed.

Peter Randall, at the Duke Symposium and again in Copenhagen, continued to pound his point with a catchphrase “think muscle” merely on the basis of his little triangular muscle flap transposed from the weak to the strong side in the inferior portion of the lip on one side in unilateral and on both sides in bilateral clefts. Yet even he was not actually joining muscles in bilateral clefts, and I was provoked to suggest:

Peter, let’s stop this “think muscle” and get on with “act muscle” by really joining them across the cleft.

The spirited Ian I. Jackson of Glasgow, Scotland, stood several times during this International Congress in Copenhagen to concur with the importance of joining the orbicularis oris muscle in cleft lip. This was his stand:
Conventional methods of repair emphasize skin rather than muscle reconstruc­tion and disregard the anatomy of the cleft muscle. In the lesser segment careful dissection has shown it to be inserted into the dermis at the cleft margin, the alar base and the front of the maxilla; in the greater segment the insertion is largely into the nasal spine and the base of the columella. The most important part of the repair is detachment from this insertion and accurate reconstruction. The method of skin repair is now considered to be of much less importance than in the past since lip length and contour are controlled by the muscles. In the bilateral case a procedure based on that recently published by Millard has been successfully developed.

A discussion with Randall later in 1973 revealed that he had been incited out of “think muscle.” He now follows his two-stage forked flap and bilateral adhesion with a later two-stage definitive lip closure that dissects the muscles widely. The muscle of one lateral lip element is freed from mucosa and skin, brought down and passed through a tunnel in the prolabium, somewhat in the Duffy fashion, but well across to the opposite side. In a second stage he repeats this muscle shifting on the other side with an actual crisscrossing of the muscle fibers. There are several discrepancies here, however, such as an area without muscle—and possibly contour too—in the upper triangle of the lateral lip element and an adjacent one in the upper prolabium. Then, too, even after these four operations there is still no labial sulcus!

In fact, in 1974 Randall and Lynch acknowledged:

Though the forked flap reconstruction and the overlapping of muscular flaps through the prolabium jeopardizes the blood supply to the philtrum we have had only a few minor areas of tissue loss in these patients. It should be noted that the midline vermilion is left intact with the underlying gingiva so as to provide an additional blood supply. This means that reconstruction
of the sulcus will have to be done later. It is interesting, however, that only five of our patients have “whistling” vermilion deficiencies perhaps reflecting the addition of muscle to the prolabium.

MUSCLE UNION CAN FOLLOW AN ADHESION

In 1974 Oneal, Greer and Nobel of the University of Michigan reported having adopted my muscle union and forked flap banking for bilateral clefts as a two-stage secondary procedure. They first tried it following a primary bilateral adhesion and found it effective. As they noted, the condition of the nose and lip after their bilateral adhesion procedure presented a short columella, redundancy of lateral vermilion with orbicularis oris bulges laterally and deficiency of the central vermilion. Banking the forked flap carrying the bilateral scars and joining the muscles across the cleft behind the prolabium, followed in two to three months with shifting of the forked flap into the columella, was successful for them as a delayed primary procedure.

In 1975 Alfred Rehrmann of the University of Düsseldorf still expressed his preference for closing the bilateral lip clefts with a two-stage modified Veau procedure, crossing two lateral muscular vermilion flaps into the prolabium vermilion.

Then, at about 5 years, he is willing to cut a forked flap out of the prolabium, join the lateral muscles, and lengthen the columella.
The result he published showed severe lip scars. My contention against not bringing the muscles together in the original closure is that it forces sacrifice of the lovely scars of infancy. To have to go back into the lip at age 5 years to get a forked flap and to get the muscles together is undesirable. This, of course, is the prime motivation for the banking procedure.
N A T U R E shortchanged the prolabium to such an extent that this blob’s main asset is its skin. It has no cupid’s bow or tubercle, and the vermilion encircling it is certainly inadequate. Gillies and Kilner put it this way:

The mucous membrane of the premaxilla, having failed to unite with that of the advancing lateral processes, forms a pseudovermilion border for the prolabium and this has tempted many a surgeon to utilize it in the construction of the new lip margin to the permanent detriment of the patient.

T O  S E E  O R  N O T  T O  S E E

The prolabium vermilion serves better behind the scene as it is thin and attenuated, with a color and texture slightly different from those of the lateral lip segments. Often its epithelium has a tendency to scale and peel. Here are three prolabiums, each with its inferior vermilion demonstrating an offensive but common scaliness.
These characteristics render it more appropriate as a liner of the central tubercle than as the mid-anterior cover. I have been advocating the former role since 1954.

As early as 1927 Federspiel of Milwaukee designed lateral vermilion flaps which he interdigitated beneath the prolabium, but most surgeons have chosen to retain the prolabium's inferior vermilion. Victor Veau of Paris retained some or all of the inferior prolabium vermilion. Celesnik of Ljubljana and Perko of Zurich have modified Veau to retain a portion.

Other modern methods meticulously design front billing and bolstering of this miserable mucosa. Some surgeons, like Cronin and Georgiade, use only a small section of it, which often presents a pink peekaboo patch in the center of the lip red.

Bauer, Trusler and Tondra, in similar principle, retain a rather wide vermilion cuff on the prolabium and introduce lateral vermilion behind it in two stages.

They admitted in 1971:

The most noticeable disadvantages to this method of cheilorrhaphy have been concerned with the utilization of the mucous membrane of the prolabium to form the central portion of the vermilion of the lip. This does not seem to be completely normal mucous membrane. It has a tendency to dry out and occasionally to fissure. However, we have noted that as the patient matures, the quality of the mucous membrane tends to improve in
both function and appearance. In most cases there seems to be a rather
dramatic improvement in the quality of the mucous membrane at about 10
years of age.

They then mentioned the common problem of notching in
this same area, indicating to me that if after all this perseverance
with the abnormal mucosa secondary surgery is still required for
the whistling deformity, it just was not worth it after all. Quite
apart from all the other disadvantages of this type of vermilion
approach, there is far too much visible scarring in the mucosa.
Although not quite as noticeable as in skin, white scars in the
"red" vermilion are not attractive and should be limited to one
midline vertical seam of union in the area of the tubercle.

Manchester and Spina, among others, unroll the entire inferior
vermilion and bolster it from behind by various lateral flaps.
Broadbent, happy with this aspect of the Manchester method,
when challenged about its questionable scaliness during the 1973
Cleft Symposium at Duke, defended salvaging this vermilion in a
visible position:

I would far rather have it there than discard it. If necessary, rub a little
Vaseline on it if it's dry.

Randall, in late 1973 in Hollywood, Florida, announced his
persistent preference to retain this vermilion in a visible position.

It is encouraging to see that Cronin has gradually shifted the
prolabium vermilion out of sight. In 1957 he kept a triangle in
front, in 1964 he retained a cuff but by 1971 he left only the ridge
and turned the rest of the vermilion behind the lateral vermilion
flaps. In October 1973 he reconfirmed his decision to hide or
discard this prolabium vermilion.
Here is an example of a case by Cresswell using his narrow lateral muscle flaps joined under the prolabium vermilion which achieved a full-bodied central free border. Because of Cronin's earlier influence, Cresswell had retained the prolabium vermilion in a visible position with an unfavorable effect. Its subsequent removal improved the result, but secondary excision is more difficult and tends to produce more scarring of the vermilion.

Too often traditions are passed down from generation to generation parrot fashion. José Barros Saint-Pasteur in a 1964 issue of *Revista Latino-Americana de Cirurgia Plastica* stated flatly:

> The vermilion of the prolabium must never be excised.

and gave Axhausen, Veau, Schultz, Trusler, Marcks, Cronin and Spina as his defense. Of those no longer with us or retired, Trusler had second thoughts on this subject before his passing. Cronin and Spina are left, but Cronin prefers to hide this miserable piece himself now.

Since 1954 I have been using the inferior vermilion of the prolabium as a hidden backup lining for the center of the vermilion free border. Overlapping it with equal vermilion flaps from the lateral elements not only partially camouflages the bilateral cleft effect but places the scar of union in the unnoticeable midline, creates a tubercle and remedies "whistling deformity" deficiency.

It was pleasing, therefore, to see Musgrave's 1972 editorial against front billing of the prolabium vermilion in Goldwyn's *Unfavorable Result*.
While it is imperative that the central mucocutaneous ridge be saved, the vermilion of the central prolabium can be very poor building material. As the years pass, this central mucosa frequently becomes dry and parched and may develop superficial keratotic plaques, particularly in cold weather. The knowledgeable surgeon should, therefore, as much as possible, introduce lateral vermilion medially underneath the prolabium in interdigitated fashion and should bring in also adjacent lateral subcutaneous tissues. Nothing should be discarded other than a minimal paring of epithelium. The central prolabium mucosa should be turned as a hinged flap for lining. Like the unattractive chorus, it is essential to the overall production but should not be "front and center."

In 1974 Oneal, Greer and Nobel of the University of Michigan noted:

There is controversy about where to place the original prolabial vermilion. Both Manchester and Duffy use it anteriorly. We suggest that it is better to move it posteriorly, leaving the prolabial white line and bringing the redundant vermilion of the lateral segments to the midline. If even a small remnant of the original prolabium vermilion is left below the prolabium, it is always noticeable; this does not give as normal a vermilion contour, and the resulting groove (so commonly seen) is difficult to correct.

A MADE BOW IS BETTER THAN NO BOW

There are also many surgeons who feel that the mucocutaneous junction of the prolabium is sacrosanct. In 1971 Cronin included in his eight established bilateral principles:

The vermilion ridge, or white line of the inferior border of the prolabium, should be preserved.

The prolabium, however, seldom sports a snappy "white roll" ridge at the mucocutaneous junction and never the sensuous double curves of a normal cupid's bow. Rather the mucocutaneous junction encircling three-quarters of the prolabium is vague and runs in a rounded, uninteresting, single curved line and can be discarded without emotion for a better one.

If in a certain case the mucocutaneous ridge were truly prom-
inent, it certainly could be saved with advantage since a scar above the white roll could thus be avoided. Yet it is better to bring in a true ridge from the sides if the prolabium mucocutaneous junction is not literally outstanding.

VERMILION FLAPPING IN EVERY DIRECTION

The vermilion encircling the border of the prolabium is inadequate and of different color and texture but it can be used to advantage. The vermilion of the cleft edge of the lateral lip element is attenuated in its upper part but soon swells into normal fullness and is ridged with a true white roll. Even the upper attenuated portion in the lateral elements can be of value. Yet to achieve the most efficient and economical use of all tissue, quite a bit of juggling of vermilion flaps is necessary.

The decision to hide the inferior prolabium vermilion is logical; to scrap its mucocutaneous junction depends on the specific ridge. A double curve cupid’s bow incision at the prolabium mucocutaneous junction allows the turndown of the inferior vermilion as a flap (e) based on the free border. As much cuff is developed as is considered necessary to back the lateral vermilion flaps to form a full-bodied free border and tubercle. Enough base for viability must also be maintained. Then the remaining posterior inferior mucosa of the prolabium, along with the posterior half of the vermilion border of its sides (m), is cut free from the prolabium as it itself is dissected free from the premaxilla. These portions are left attached to the premaxilla in the vague shape of an inverted M of mucosa which is used to cover as much raw area on the premaxilla as possible to aid in creating one side of an upper labial sulcus.

The attenuated vermilion of the upper cleft edge of the lateral elements is trimmed upward as flaps (l) to be used to fill the vestibular defect after alar base release. The lateral edge paring then continues as full-bodied vermilion flaps carrying a true ridged white roll (b) if required. These flaps are incised and transposed to overlap the prolabium vermilion turndown flap (e).
The incorporation of the white roll in the lateral vermilion flaps also offers a camouflage by interrupting the vertical lip skin scars. The lateral vermilion flaps, when topped with the white roll ridge, continue this line across the vertical bilateral skin scars under the inferior border of the prolabium. Each curves half of the cupid's bow to meet the other in the midline, and any excess vermilion can protrude as tubercle. The chance of a whistling deformity has simply been averted.
REGROUPING BEFORE THE CHARGE

IN the bilateral cleft, as there is no normal side with which to compare, it is necessary to project the general ideal normal in the mind's eye just above the specific case. A constant comparison between these two by a vertical nystagmus will facilitate the transformation.

Before we make a final outline of the present approach, let us review again specific bilateral goals. All of us want to produce a lip that is not too tight transversely or too long vertically—one that has an adequate upper sulcus, muscle-to-muscle union, a white mucocutaneous roll, a full vermilion, a cupid's bow with a midline tubercle and a dimpled philtrum of natural shape. We should like to achieve these in infancy when scars tend to heal smoothly.

All of us abhor having to go back into an excellent lip, which has nearly invisible scars from surgical closure in infancy, to get adequate tissue to correct the nose. To get a good lip and avoid reopening it forces the banking of the forked flap. The ultimate manner of banking may vary, but the principle is here to stay.

All of us want a columella long enough to allow the nasal tip to stand proudly forward with alar bases that are in a normal position, forming a nostril sill with the feet of the columella base. It would be ideal if this could be achieved early—for better scars, for better nasal growth and development and to avoid the patient's enduring the stigmas of the typical mid-stage broad lip and flattened nasal tip deformities during preschool and school years.
Long-term banking is inconvenient, but experience continues to prove that division of the nose from the prolabium in infancy, particularly in complete bilateral clefts, results in a lip that becomes too long in vertical dimensions. Thus, at least in complete clefts, the second-stage shifting of the forked flap into the columella is better postponed until preschool age of five to six years. The two-stage forked flap has the added advantage of avoiding convergence of the points of five flaps all at the same time with the threat of compromising the healing at this center of scar confusion.

A CHANGE OF EMPHASIS IN PRINCIPLES

Thomas Cronin, under whom I trained for a time, for whom I have respect and with whom I occasionally disagree, stated in 1971:

Certain principles and objectives of treatment have become fairly well established. These are:

1. The prolabium should form the full vertical length of the middle of the lip.
2. The vermillion ridge, or white line of the inferior border of the prolabium should be preserved.
3. The thin prolabial vermillion should be built up with vermillion muscle flaps from the lateral lip segments but no lateral skin flaps.
4. Correct disparity between premaxillary and maxillary segments of the alveolar arch, preferably nonsurgically.
5. Prevent or correct, if possible, collapse of maxillary segments behind the premaxilla.
7. Bone grafting to stabilize the premaxilla.
8. Lengthen the short columella.

Four other fundamental principles merit consideration and even priority.

1. Premeditated adequate columella planning will avoid the need for later lip reentry. Mere paring of the edges of the prolabium is wasteful; reduction of the prolabium to natural philtrum size and shape is desirable; the columella is too damn short, so the forked flap banking maneuver is indicated.
2. *The creation of continuity of the prolabium* with the lateral lip elements involves joining lateral mucosa for sulcus, muscles for function behind the prolabium and “white roll” and vermilion for scar camouflage and cupid’s bow below the prolabium.

3. *Early and permanent nasal alar base positioning* is ensured by primary medial rotation and advancement of these bases with their denuded tips or subcutaneous pedicles attached to the septum for stability.

4. *Total division of the prolabium from the nose should be postponed.* Eventual picking up or unfolding of the banked forks and alar bases to make possible their medial swing across the nasal floors and up into the columella will achieve columella construction and nasal tip release. A banked homologous septal cartilage strut may be used for extra temporary support. This probably should be accomplished before school age of five to six years to avoid impeding physical and psychological growth.

**TWENTY-ONE STEPS**

Thus the steps in the management of bilateral clefts of the lip and palate can be increased to 21.

1. Practical but undercorrected positioning of the premaxilla in preparation for lip surgery (A, B or C).
   - A. Elastic band to headcap.
   - B. Orthodontics (McNeill-Burston-Hotz-Rosenstein).
   - C. Mechanical squeezer (Georgiade-Latham).

*Ears, palate and lip*

2. At two to four weeks insertion of ear tubes if indicated.
3. At the same time closure of the soft palate (when possible).
4. At the same time definitive lip closure.

*Definitive closure*

5. Use of any excess prolabium mucosa to cover the premaxillary raw area.
6. Reduction of prolabium to philtrum dimensions (5 to 8 mm.) by paring forked flap from lateral sides.
7. Turndown of inferior prolabium vermilion with cupid’s bow
incision for use as invisible backing to the central tubercle.
8. Freeing the prolabium from the premaxilla.
9. Turnup of cleft edge mucosal flap from upper portion of lateral lip segments to be used to fill defect in lateral vestibule following release of the alar base from the maxilla.
10. Remaining cleft edge mucosa carrying a white roll ridge cut as a full-bodied flap from each lateral lip element. If the prolabium mucocutaneous ridge is outstanding, then this ridge should be preserved and need not be brought with the lateral flaps.
11. Lateral lip element freed from the maxilla and skin edge freed slightly from the muscle.
12. Advancement of the mucosa and muscle of the lateral lip elements to join each other in the midline in front of the premaxilla and behind the prolabium to obtain an upper sulcus and muscle continuity.
13. Replacement of the prolabium over the joined muscles and between the skin edges of the lateral elements the full vertical length of the lip with no tension on the skin scars.
14. Dimple of the philtrum created.
15. Alar bases cut free from the lateral lip elements as full-bodied flaps and each flap divided into two components, a skin flap and a subcutaneous-muscle flap.
16. The deeper subcutaneous flap advanced to its mate of the opposite side and sutured to it at the nasal spine with Vicryl; alar bases thus advanced on top of the lip advancements with permanent reduction of the alar flare and fixed positioning of the alar bases.
17. Banking the forks by suturing them in pyramid fashion to the alar base skin flaps in the floor of the nose, or better between the lip and the alar bases in whisker fashion.

Columella lengthening

18. Nasal tip release by secondary advancement of the forked flap and alar bases to form nostril sills and columella. (The timing of this maneuver may vary from six months to six years.) This staged forked flap avoids the five points of the
one-stage procedure. A banked homologous septal cartilage strut can be used for early support in the child, and at 15 to 16 years during final scar revisions an autogenous septal strut can be added.

Note: Mersilene suture has been replaced by Vicryl because of occasional postoperative infection and "spitting."

**Palate**

19. Closure of the hard palate with vomerine flap at 18 months. If premaxilla is well within the arch, closure of the alveolar clefts includes any fistulae.

20. Lengthening of palate if necessary after four to five years of age with island flap or reduction of the velopharyngeal aperture with a pharyngeal flap.

21. Cancellous bone grafts into the alveolar gaps at eight years.

This is not a 21-point blueprint for all cases. The principles are there to be adapted to the specific problems. Dentist Simon Hullihen was still paring the cleft edges and approximating them with Paré-type transfixing needles and yet he realized the importance of variation for the individual case. He wrote in 1844 in the *American Journal of Dental Science*:

But in addition to these general indications a particular plan should be adopted in each operation with the view of making a well formed lip, and this plan must be made with a strict reference to the peculiarities of the case, and be carefully and plainly marked out upon the lip before the operation is commenced.

Again it is important to reflect on those who have had any specific influence, large or small, on the final design being described, and this is their credit line in alphabetical allocation: AdamsBerkowitzBrowneBurstonCollitoCroninDesaultDuffyFaraFederspielGeorgiadeGilliesHortonKernahanLathamMiryMirMuirOnealRandallSchultzWalker.
INCOMPLETE CONDITION

NATURE has left some strings attached to its incomplete clefts which fortunately restrict the severity of the deformity. Usually the premaxilla is united to one or both sides of the maxilla and seldom protrudes. There may be some upper labial sulcus. The clefts in the lip are not complete, and the bridges may be wide enough to have passed some muscle into the prolabium. The integrity of the nasal floors, being intact, reduces the amount of alar base flare, but these floors are usually wider than normal. The nasal tip is less flattened, and the columella can be nearly normal although usually it is shorter than ideal.

WHAT TO DO

If the columella is adequate, the latest rendition of the pure rotation-advancement method is preferred. It has been described in detail at the end of Chapter 15.

If the columella is inadequate, the ultimate result should eventually be about the same but the means of accomplishing it become complicated. All the latest rotation-advancement actions adapted to bilateral clefts are involved.

At first consideration there may seem to be a lot of flaps going in helter-skelter direction like the proverbial Keystone Kops, but actually each action is logical and quite simple in itself. The
necessity in bilateral clefts of doubling each procedure may cause temporary confusion, but the demand for symmetry renders the second side merely a replay.

To facilitate the execution of the basic philosophy of taking what is available that is not needed where it is and shifting it in order to create what is wanted, the surgeon must superimpose in his mind's eye the ultimate ideal normal result over the original deformity. This vision will not only clarify the problem but project the solution. Prior to the actual surgery, it is well to run a replay elucidating the reason for each specific action. Then, on the final forward rerun, the surgical sequence will be economical, effective, symmetrical and correct.

John Homans of Harvard, a general surgeon with insight beyond his time, said in 1940:

The difficulty with plastic surgery is that it requires imagination. . . . The expert must have an ability to visualize an end result against a most unpromising background and patiently, often in a multitude of steps, work toward the fulfillment of his vision.

No deformity makes this demand more than a bilateral cleft of the lip and palate. To understand one completely we have to do one, and it is logical to start with the incomplete type.

**MEASURING AND MARKING THE PROLABIUM**

In the usual bilateral incomplete cleft of the lip, the vertical height of the prolabium is shorter than the lateral lip elements but is usually long enough. On the other hand, the tissue in the upper portion of the longer lateral lip elements is often attenuated, lacking in muscle and contour. The prolabium is usually wider than a normal philtrum, but the columella is shorter than ideal. These four conditions suggest that the prolabium should set the vertical height of the lip, that the upper portion of the lateral elements are expendable and that the sides of the wide prolabium are available for eventual lengthening of the short columella.

If a vertical line is dropped straight from the lateral base of the columella on each side to the inferior mucocutaneous junction of
The double arch of the cupid’s bow is marked on the inferior prolabium which from peak to peak will be 4-10 mm, or 2 to 3 mm, an arch.

Vermilion below the bow is turned down for lining.
Calipers are marking normal and equal commissure to bow peak limit point on each side as well as half a bow distance on the lateral edge for flap b.

The vertical height of the prolabium is being matched along the lateral.

When the upper vermilion edge is attenuated move laterally as far as possible out to the limit point.

Then measure the future opposing edges for perfect matching.
the prolabium, the distance will average from 8 to 13 mm., which is a normal upper lip length. The width between these lines should be from 4 to 10 mm. (preferably 6 mm.), or the size of a normal philtrum. The midpoint along the inferior prolabium mucocutaneous junction marks the center of the cupid's bow with the potential peak of each arch 2 to 5 mm. (3 mm.) lateral along this junction line. All prolabium tissue lateral to that marked off for a normal central philtrum is to be pared and preserved for a future forked flap.

The double curve of the cupid's bow is marked along the inferior mucocutaneous junction of the prolabium, and vermilion beneath this will be turned down as a lining flap. If the mucocutaneous junction on the prolabium is well differentiated, it should be preserved. If not, it can be taken in the turndown flap of vermilion.

**Measurement Matching of the Prolabium to the Lateral Lip Elements**

The length relationship of the prolabium to the lateral lip elements varies in each case and even on each side. In the normal lip the distance from the commissure to the peak of the bow along the mucocutaneous junction line can be 18 to 22 mm. or more. Once this normal distance is determined for a specific case, a point is made on each side to mark the limit of allowable lateral paring.

Above this point, the lateral lip edge is measured the exact length of the vertical height of the prolabium. When the lateral lip element is longer than the height of the prolabium, however, it is better to de-epithelialize the excess in the upper portion and retain it as a dermal extension on each lateral lip element to be used as a tether during the medial advancement of these segments. During the paring of the edge of the lateral element, a full-bodied vermilion flap b topped with a "white roll" ridge should be cut slightly longer than the length of one arch of the cupid's bow as it will, in fact, be creating half of the bow.
Shaped philtrum with side wings free for first stage of fork banking and vermilion lining flap drooping but ready for backup of tubercle.

Skin bridges marked for de-epithelialization.

Prolabium marks scored.

Bridges divided through the nostrils.

Philtrum has been pared of its side forks. Inferior vermilion being turned down.

Shaped philtrum with side wings free for first stage of fork banking and vermilion lining flap drooping but ready for backup of tubercle.
SCORING AND CUTTING
THE PROLABIUM

All three elements of the lip have been measured and marked. The muscleless bridges of the longer lateral elements have been
cross-marked for de-epithelialization, which will produce two
leading dermal handles. The main part of this dermal extension is
left attached to the lip elements and can be used to pull and
tether the lateral elements upward and inward to each other and
the septum, bringing the lateral muscles into better position.

The prolabium is scored to delineate the philtrum, the forked
flaps and the inferior vermilion turndown flap. The skin bridges
have been divided all the way through into the wide nostrils. The
philtrum is shaped by stabbing along the scoring with a No. 11
B-P blade to pare off the lateral forks. Then the inferior vermilion
cuff is dissected as a turndown flap based on the distal end of the
prolabium. Thus the prolabium has been “drawn and quartered”
into a central philtrum, the two side wing forks and a vermilion
turndown flap (e).

Paring one fork from the
prolabium up to the
 columella base.
FREEING THE PROLABIUM AND THE LATERAL LIP ELEMENTS

Once the prolabium has been divided into its various flaps, the entire ensemble is dissected free from its attachments to the premaxilla right up to the nasal spine. The incision across the inferior attachment must leave enough pedicle for vermilion flap to remain viable on the end of the prolabium. All other mucosa in this area should be left attached to the premaxilla for covering its raw area and lining the posterior wall of the upper labial sulcus. The same economy is used for the forked flaps. A narrow cuff of vermilion is preserved along each lateral side of the fork to add body and cover during the banking, and when finally advanced into the columella this red rim will be hidden inside the nostril and sutured to the septum. Any remaining lateral vermilion running up on the sides of the front of the premaxilla again should be spread and used to cover as much raw area as possible to help in the sulcus lining. Thus the mucosa left on the anterior surface of the premaxilla is shaped somewhat like an M and is capable of creating at least a good part of the posterior side of the upper labial sulcus. The lateral lip elements are then dissected by undermining from their attachments to the maxilla to ease the lip closure.
Dividing the prolabium elements from the premaxilla.

Lateral lip element (Rt) being freed from the maxilla.

while leaving as much mucosa M as possible on the premaxilla and still keep inferior vermilion flap E viable.

Similar undermining on the left.

edge starting upward from the lateral limit point.
De-epithelialization of the attenuated bridge portion of the upper lateral lip elements shortens these long segments and provides dermal tips for lifting and tethering the lateral lip elements.
PREPARING THE LATERAL LIP ELEMENTS

The lateral lip elements hang longer than the vertical length of the prolabium, but their upper portions are attenuated, lacking in muscle and contour, and their true muscle bulges are positioned more laterally and inferiorly. The crosshatch markings of the deficient upper bridges indicate the zones for de-epithelialization. These raw dermal tips will be advanced medially and upward and suspended with 4-0 Vicryl sutures to each other and to the septum at the nasal spine. This lift will take the tension off the closure and set the ideal stage for lip construction and healing.

The lateral lip elements are pared of full-bodied vermilion b flaps edged with a white roll ridge. The paring is limited, of course, by the normal distance already marked at the potential bow peak from the commissure.

PREPARING THE LATERAL SKIN EDGES

The skin of the cleft edges of the lateral lip elements is trimmed carefully to fit and approximate exactly the sides of the pared prolabium. The skin is also undermined 2 to 3 mm. from the orbicularis oris muscles along the lateral lip edges to ensure eversion in the closure.
Deep alar base and lateral lip suspension being achieved.

Total alar base flap being developed.

The dermal tips of the lateral lip elements are being sutured to each other and the septum at the nasal spine just below the d flap union.

Alar base flap split into two flaps—a skin flap D and a subcutaneous flap d.

The alar base subcutaneous d flaps are being sutured to each other on the septrum.
Preparing the Alar Bases and Placing the Suspension Sutures

The alar bases have been divided from the lateral lip elements in the usual manner with a No. 11 B-P blade. They are also incised within the vestibule to form full-bodied flaps. Each flap is then dissected into two components—an alar base skin flap D and a subcutaneous-muscle flap d. A 4-0 Vicryl suture is used to join the two d flaps to each other and to the septum, reducing the alar flare and narrowing the wide nostrils. After this suture, a similar suture is placed in the two dermal tips of the lateral lip elements to bring them together and hang them on the septum at the nasal spine just below the fixation of the d flaps.

Probably the most logical order of suspension suturing will first bring the dermal tips of the lateral lip elements together and to the septum and then bring the alar subcutaneous flaps to each other and to the septum just above the lip fixation suture.

First suture the dermal tips of the lip elements together and to the septum at the nasal spine.

Then suture the alar subcutaneous flaps to each other and to the septum above the lip stitch.

Reversing the order.
SUTURING THE LATERAL LIP ELEMENTS TOGETHER

First the posterior mucosa of the lateral lip elements are sutured together with 4-0 chromic catgut (Ethicon \#752G) in front of the premaxilla and behind the prolabium to form the anterior side of the upper labial sulcus. Then the orbicularis oris muscle fibers are approximated with 4-0 Vicryl (Ethicon \#V-494G) mattress sutures.

Suturing the mucosa of the lateral lip elements together.

Then the muscle fibers are brought together with Vicryl mattress sutures.
Dimpling the Philtrum

A midline vertical slit is made in the subcutaneous tissue of the philtrum deep to dermis. A 4-0 Vicryl suture picks up the dermis in the inferior depth of the slit and fixes it to the under muscles of the lip. As the suture is tied, the philtrum dimple is depressed.

A 4-0 Vicryl suture picks up the dermis of the prolabium and pins it to the lip muscle.

A midline vertical slit is made in the subcutaneous tissue of the prolabium to the dermis.

Tying the stitch pulls down a dimple.
Suture of subcutaneous tissue of prolabium to subcutaneous layer of lateral lip element with 5-0 and 6-0 catgut emphasizes the dimple and improves the apposition of the skin edges.

Closure of mucosa and muscle of lateral elements behind the prolabium relieves all tension. 6-0 silk sutures bring the skin edges together with ease.

Overlap of the lateral vermillion flap b with its mucocutaneous ridge over the prolabium vermillion turndown flap to form half of the cupid's bow. The opposite flap b will complete the bow with a midline tubercle.
The prolabium forks are banked by approximation with the alar base D flaps, tip to tip and raw area to raw area like the clasping of "praying hands" to form two pyramids, one in each nasal floor.

Another method of banking, which I prefer particularly in complete clefts although it can also be used in the incomplete clefts, is the subalar whisker position between alar base and lateral lip element. This maneuver was described in Chapter 23 and will be described again in Chapter 28, with examples shown in Chapter 30.
This is indeed an economical design with minimal discard of tissue.

Tongue stitch is placed as a safety precaution.

Logan bow assists in initial relief of tension and leaves the wound open for application of antibiotic ointment and eventual suture removal.
SECONDARY FORKED FLAP ADVANCEMENT

Secondary advancement of the forked flap into the columella for release of the nasal tip can be carried out as soon as three weeks later or preferably at the preschool age of five to six years.

If the ends of the forked flap are hanging free, with the aid of a membranous septal incision they can be advanced into the columella and sutured to each other and to the septum. The alar bases then can be advanced medially and their denuded ends sutured to each other and to the septum under the ends of the forked flap to reduce the alar flare and create nostril sills. If the forked flap has been banked in "whisker fashion," the same maneuver is available. If banked as "praying hands," then the attachments are unclasped except the tip-to-tip union of the forked flap ends to the alar bases. The elongated straps thus produced are advanced medially and rotated upward into the columella. A septal cartilage strut should be used to support the tip and fork; if in childhood, it can be banked cartilage, but after 15 years it should be autogenous septal cartilage.

PERSONAL CASES

At three and a half months one-stage lip closure was carried out.

1. The prolabium was freed from the premaxilla and the lateral lip elements were freed from the maxillae.
2. A short forked flap was pared from the prolabium. (Microscopic sections of the prolabium revealed skeletal muscle fibers, as might be expected in an incomplete cleft.)

3. Lateral mucosa and muscle were joined behind the prolabium.

4. Lateral vermilion flaps carrying the mucocutaneous junction were used to overlap the turndown of the prolabium vermilion.

5. The forks were sutured to the Simonart’s bands in the nostril floor for banking.

Six months later columella lengthening was accomplished by the forked flap, and the alar bases were denuded at their tips, advanced and sutured to the septum.

Note increase in vertical length of short prolabium after joining of lateral muscles.
Here is an example of a bilateral incomplete cleft treated as just described with the second-stage columella lengthening of the banked forked flap postponed until just before school age.

At three months of age:

A. Bilateral myringotomy, suction and insertion of tubes by F. Pullen.
B. Soft palate closure.
C. One-stage closure of bilateral cleft lip.
   1. Prolabium freed from premaxilla and lateral lip elements freed from maxillae.
   2. Bilateral forked flap pared from sides of prolabium.
   3. Posterior mucosa of prolabium used to cover raw anterior premaxilla.
   4. Skin bridges with or without muscle denuded of epithelium, advanced to each other and sutured to the septum behind the columella, relieving tension of lip closure and reducing alar flare.
   5. Mucosa and muscle of lateral elements sutured to each other behind the prolabium.
   6. Prolabium dimple created with Mersilene suture.
   7. Lateral vermilion flaps carrying mucocutaneous ridge used to overlap the inferior prolabium vermilion.
   8. Forks sutured to alar base flaps in "praying hands" pyramids.

B.D. 7-22-72
F.H. No clefts
F.T. Uneventful
O.C.A. None

10-27-72. Ear tubes. S.P. Lip Closure
Patient returned from Virginia at age three years for hard palate closure and minor lip revision. At 4½ years she returned for “unbanking” of the forks to lengthen the columella before starting school. Here she is soon after the elevation of her tip.

A short prolabium

Here is a primary case that has been added too late to be included in the statistics. It is important because it presents the solution to
the problem of the short prolabium which has been adjusted to form an adequate philtrum without introduction of skin flaps from the lateral lip elements either above or below.

At 7 months of age:

1. Forked flap as marked was taken from the sides of the prolabium including Simonart's bridges and a portion of the lateral lip elements with upper horizontal extensions to shorten the long lateral elements.

2. The prolabium was freed from the premaxilla, some of the vermillion being kept to cover its raw surface.

3. The mucosa and muscles of the lateral lip elements were brought together behind the freed prolabium, which was replaced in philtrum position with a dimpling stitch.

4. Lateral vermillion flaps carrying a mucocutaneous ridge were used to overlap the prolabium vermillion to form a cupid's bow.

5. The forked flap was banked in whisker position.

Introduction of muscle and mucosa behind the prolabium, addition of vermillion-mucocutaneous ridge flaps inferior to the prolabium and matching the sides of the lateral lip elements to the sides of the prolabium succeeded in increasing the effective length of the short central element into good balance.

EARLY COLUMELLA LENGTHENING. Because of the incomplete extent of the clefting, the intact alveolus and a short prolabium, early advancement of the banked forked flap into the columella was considered justified and less likely to produce a long lip in vertical dimension. At age 11 months, or 4 months after banking of the fork, it was advanced into the columella.
Here is another late case not included in the statistics but important because it demonstrates again how to handle the short prolabium without paying the exorbitant price of introducing lateral skin flaps below or even above the prolabium and without dividing the prolabium from the nose primarily.

B.D. 11-3-74  
F.H. Brother with severe unilateral CL&P  
F.T. Uneventful  
O.C.A. None

At the time of lip closure, the forked flap was banked in whisker position. Then as this was an incomplete cleft, the forked flap was moved out of the banked position into the columella with nasal tip release at $2\frac{1}{2}$ years. She is shown 2 weeks after surgery.
The lack of palatal cleft, absence of premaxillary protrusions and severe shortness of the prolabium (6 cm.) stimulated postponement of soft tissue closure in this case. Time did not improve the relative length of the prolabium, so primary definite surgical lip closure was designed at 13 months to correct this discrepancy also.

1. A forked flap was marked taking as much prolabium as was expendable from the philtrum. It also included the pared edges of the lateral lip elements and high transverse wedge triangles to shorten these too long elements.

2. A turndown cuff of inferior vermilion of the prolabium still allowed most of the posterior mucosa to be dissected from the backside of the prolabium. Based on the premaxilla, this mucosal flap was used to cover the denuded anterior surface of the premaxilla once the prolabium had been freed up to the base of the columella.

3. The usual lateral vermilion flaps carrying mucocutaneous ridge were cut from the sides of the lateral lip elements.

4. The mucosa and muscles of the lateral lip elements were advanced and sutured to each other across the midline. The prolabium was split on the undersurface and then replaced into philtrum position with a dimpling stitch. Small transverse incisions at the top of the prolabium allowed the skin tips of the lateral advancement flaps to fit in at the base of the columella.

5. The lateral vermilion flaps then overlapped the turndown of the prolabium vermilion to form a cupid's bow and to add slight length to the central component.
Again a relatively short prolabium was cut to match the relatively long lateral lip elements by the design of the forked flap, which simply is banked at this stage. Introduction of mucosa and muscle behind the prolabium and overlap of lateral vermilion carrying a mucocutaneous ridge below the prolabium bring more fullness to the forlorn philtrum component. In fact, these actions negate the necessity of dividing the prolabium from the nose at this early age or of introducing lateral skin flaps below the prolabium at any age!!

**EARLY COLUMELLA LENGTHENING.** As in the previous case, the incomplete clefting, intact alveolus and short prolabium seemed to justify early shifting of the banked fork into the columella. At age 16 months, just 3 months after the fork was banked, it was used to release the nasal tip.
Although these incomplete clefts have more columella than do complete clefts, they are still short of tissue and if not lengthened will partially snub the nasal tip in adolescence and adulthood.

Another late case not included in the statistics but a good example of a bilateral incomplete cleft with short columella. Family history was impressive with father having a bilateral cleft lip and mother's first cousin a cleft lip and palate. At six months of age, first stage of the forked flap was banked and mucosa and muscle of the lateral lip elements were united behind the columella. Cupid's bow was created with lateral mucocutaneous ridge and vermilion flaps transposed below the inferior border of the prolabium in front of the turndown of prolabium vermilion. The forks were banked in praying hands position in apposition with the freed alar bases and are readily available for advancement into the columella at about 4½ years of age.
When one side of a bilateral cleft is incomplete, the situation reduces the amount of discrepancy and distortion not only in the lip and nose but in the premaxillary-maxillary relationship. Any case benefited by reduction of distortion because of the incompleteness of the clefting on one side then presents the problem of asymmetry. LeMesurier, in 1962, stressed the importance of achieving symmetry in asymmetrical bilateral clefts:

If the two clefts are originally about the same, it is not difficult to maintain the symmetry, but if they are considerably different the cuts should be made so that the parts of the lip left beyond them, when fitted together, will make the two sides as nearly symmetrical as possible.

Thus it is artistic logic that with one side completely cleft the incomplete side must be rendered complete to facilitate closure for the sake of symmetry, preserving any excess tissue for special use.

**Basic Rules**

1. The original vertical length of the prolabium will determine the vertical length of the lip.
2. Each lateral lip element must be cut to match the corresponding side of the prolabium.
3. The prolabium is usually wider than a normal philtrum and thus is pared its full vertical length by cutting free one prong of the fork off each side.

4. The lateral lip element is pared a similar length, but there is one limitation. The extension of the lateral paring must not exceed point x on either side, which is set on the mucocutaneous junction line of the lateral element not less than 18 mm. or much more than 23 mm. from the commissure. Of course, both sides must be pared the same.

5. When the lateral lip elements are being pared, a vermilion flap 1 is turned upward and will go into the vestibule to supply lining. A thicker vermilion flap b, carrying mucocutaneous junction ridge, is turned downward and will overlap the prolabium vermilion along the inferior border. It must be cut slightly longer than half of a cupid's bow width, and the little excess will form the midline tubercle.

**MEASURING AND MARKING**

*Width*

Most prolabiums are far wider than the normal philtrum and, if left wide, will produce a spread central portion of the lip with a broad cupid's bow—if indeed a bow is created at all. The normal cupid's bow along the mucocutaneous junction line, from the lowest skin point in the midline to the highest point of either arch, can be as narrow as 2 mm. or as wide as 5 mm. (preferably 3 mm.) with the entire bow from peak to peak measuring 4 to 10 mm. (preferably 6 mm.).

The bow peaks are marked on the inferior mucocutaneous junction line of the prolabium with methylene blue guided by calipers or preferably a trained eye.

*Shape*

Shaping the prolabium to philtrum dimensions requires paring the lateral excess of skin and mucosa. Starting at the most
The normal width of the cupid's bow is 4-10 mm. The two halves are measured and marked on the mucocutaneous junction of the inferior edge of the prolabium.
anterior lateral point of the base of the columella, a vertical line is marked with a gentle curve which breaks in slightly at the potential point of the cupid's bow peak on the mucocutaneous junction line. If the mucocutaneous junction along the inferior edge of the prolabium has a definite "white roll" ridge, it can be preserved and the bow marked just inferior to it in the upper vermillion. If the ridge is vague, it can be discarded.

Vertical length or height of lip

Matching the prolabium to the lateral lip elements is concerned primarily with the vertical length or height of the upper lip.

First precautions must be taken to ensure normal total lip width: The normal distance from commissure to height of bow peak varies from 18 to 23 mm. This is a guide as the cutoff point allowed in lateral paring of the lateral lip element. In other words, a point medial from the commissure along the mucocutaneous junction line at least 18 or 20 mm., and more if possible, must be set as the limit of lateral paring.

The normal vertical length or height of an upper lip as measured from the anterior lateral point of the base of the columella to the corresponding peak of the cupid's bow on the mucocutaneous junction measures from 8 to 13 mm. Measurements within these limits can usually be marked on the prolabium of bilateral clefts.
The vertical skin height of the prolabium is measured and this identical measurement is placed along the lateral edge at point x and extending upward. This presents a matching lateral skin edge to fit perfectly with the side of the prolabium.

Commissure to potential height of cupid's bow measures 20–22 mm. in the normal. This gives the limit of lateral digression beyond which point x must not extend.

The width of one arch of the cupid's bow is measured on the lateral lip element as high as there is well-defined mucocutaneous ridge and fullbodied vermilion. The most lateral point must be at least 20 mm. from the commissure.

This creates flap b to form one side of the cupid's bow vermilion.
Whatever this length is on the pared side of the prolabium, an equal skin edge must be fashioned on the corresponding cleft edge of the lateral lip element. With point x as the lateral limit, a distance identical with the vertical length of the prolabium is measured upward along the mucocutaneous junction of the lateral element.

Another limiting factor depends on how high along the lateral cleft edge there is full-bodied vermilion with a discrete white roll ridge. Paring this vermilion topped with the mucocutaneous ridge creates a lateral flap b, which should be full-bodied and 1 to 2 mm. longer than the distance on the prolabium of half the cupid’s bow. The attenuated vermilion above this along the upper cleft edge of the lateral element can be pared but preserved as flap 1 for vestibular lining use later.

*Flap 1*

The attenuated vermilion of the upper portion of the cleft edge of the lateral element, which is often discarded, has great value. It should be pared as a flap 1 based above on the alveolus. It is then available for lining the lateral vestibular defect created when the lip and alar base are released from the maxilla by undermining and extension of the incision medially along the intercartilaginous line. As the lip advances medially and the alar base moves forward and inward, a raw area in the vestibule is created. Previously it has been left to scar on its own, but flap 1 fills this void and reduces contracture. Bill Berkeley left me the gift of his endorsement of flap 1 which he incorporated in his bilateral cleft lip plan as presented by Hal Chaplin in Boston in 1976.
To freshen the cleft edge, the attenuated upper vermilion is cut as a flap I based on the alveolus. It is destined to line the raw area created when the alar base is released from the maxilla along the broken line.
Flap b

The continued paring of the cleft edge of the lateral lip element cuts flap b, which is full-bodied vermilion edged with a white roll ridge. The flap is scored with a No. 15 B-P blade and stabbed out with a No. 11 B-P.

When paring the lateral lip element retain the mucocutaneous "white roll" ridge on the fullbodied vermilion flap b.

This flap b will overlap the turndown flap of prolabium vermilion to form half of a cupid's bow.

SIMILAR DESIGNING OF THE INCOMPLETE CLEFT SIDE

The normal distance from commissure to height of potential peak of bow is measured on the lateral lip elements to mark the limit of allowable lateral paring. This point is stabbed with a needle dipped in methylene blue. As previously described for the complete cleft side, the right side is being measured for vermilion flap b, which again is fashioned slightly longer than half the bow's width.
The distance from the commissure to the potential peak of the bow x should be at least 18 mm, preferably 22 mm, and of course the same on both sides.

The limit of the lateral paring is determined by this measurement and is marked by stabbing a needle with methylene blue.

Starting at x measuring upward the distance of slightly more than half a bow is marked on the lateral side.
During this paring flap b is released.

The vertical height of the prolabium is measured on the right and is marked along the mucocutaneous junction line of the cleft edge of the lateral element beginning at the limiting point. Flap b is marked, scored and cut.
The right incomplete cleft side has been marked, flap b has been pared and flap l is now being pared toward its base up on the alveolus. The lateral lip element is dissected free of the maxilla, but the incomplete cleft has not yet been converted into a complete one.

On incomplete cleft side flap l is designed to enable economic use of the attenuated vermilion.

**SCORING THE FORKED FLAP**

The lateral excess of prolabium skin and vermilion is pared as future forks for the columella with their bases on the side of the columella. A 3 mm. cuff of vermilion on the lateral side of the fork can be maintained for suturing to the membranous septum during the columella lengthening procedure. Its presence during the banking time gives more bulk and reduces raw area and its contracture. Any of this vermilion not beneficial to the forks should be left on the premaxilla to reduce its raw area and assist in sulcus formation.

Prolabium is being outlined to philtrum proportions by incisions.
INCISING THE PROLABIUM

Incisions along the vertical marks on the prolabium define the lateral sides of a philtrum of normal width. Then the inferior vermilion of the prolabium is turned back as flap e, leaving enough base for viability. The remaining inferior vermilion is cut free from the prolabium but left attached to the premaxilla. This mucosa, continuous with what is left from the lateral vermilion of the prolabium not required in the forks, forms an inverted mucosal m. Careful suturing of the cuffs of mucosa m will achieve cover of much of the raw area on the premaxilla and thus line the posterior wall of the upper labial sulcus.

The inferior vermilion of the prolabium is being turned down as flap (e) for lining the free border tubercle leaving enough base for its viability. The remaining excess vermilion is left attached to the premaxilla (m) for raw area cover as the prolabium is dissected from the premaxilla.
Whatever mucosa that could be spared from the prolabium was left attached to the premaxilla. The mucosa m is being sutured over the raw area of the premaxilla to create lining for the posterior side of the upper labial sulcus.
Making the incomplete cleft complete.

Stabbing out the right fork.

Frecking the prolabium from the premaxilla.

Filtrum and forks are free from the premaxilla.
CONVERSION OF INCOMPLETE TO COMPLETE CLEFT

The incomplete cleft on the right is converted into a complete cleft. Then the entire prolabium with its inferior vermilion turnback flap and its lateral forks is elevated off the premaxilla up to the nasal spine, leaving any spare vermilion on the premaxilla for raw area cover.

Upper cleft edge vermilion flap 1 is hanging ready. The right lateral lip element is released from the maxilla and the alar base incised along the intercartilaginous line of the vestibule to facilitate its correct positioning during the lip closure. Flap 1 will fit this vestibular defect.
Whatever extra vermilion m that is attached to the premaxilla is sutured over the raw area to create the posterior side of the upper sulcus.

The incomplete cleft has been transformed into a complete cleft.
Vertical height of the prolabium determines the further upward extension of this paring so that the lateral and medial pared skin edges match.

Bilateral complete cleft

Measuring 2-5 mm. but preferably 3 mm. width of each arch of the bow from the midline.

Width of one arch and a little more is measured along the lateral cleft edge starting upward from point x, the normal commissure, to peak of bow distance.
AN asymmetrical bilateral cleft of the lip with one side incomplete and the other complete has been converted into a symmetrical bilateral cleft complete on both sides. No tissue, however, has been discarded. With the asymmetrical cleft now symmetrical we can proceed as with the more common, true, complete bilateral cleft. It is better for clarity to repeat the measurements and markings.

The two arches of the cupid’s bow are measured at 3 to 4 mm. from the center of the mucocutaneous junction of the inferior border of the prolabium. Then a slightly greater distance than one arch is measured along the mucocutaneous ridge of the lateral element as soon as the vermilion becomes reasonably full-bodied. The lateral paring of flap b must not extend laterally beyond the normal range of commissure-to-cupid’s-bow-peak distance of 18 to 22 mm. set at point x.

Further upward paring of the lateral edge should extend to create a side equal in length to the vertical height of the pared prolabium measured from its mucocutaneous junction to the lateral base of the columella. This creates matching skin edges for exact approximation.

When paring the left lateral cleft edge, one marks the attenuated vermilion of the upper portion as flap 1. This flap 1 is being
pared up to its base on the alveolus. The dotted line marks the vestibular incision for release of the alar base. The paring continues laterally, developing flap b, which is composed of full-bodied vermilion edged with the mucocutaneous ridge. Remember, the limit of the lateral extension of the paring is at point x, leaving normal commissure-to-peak-of-bow distance. The lip element and alar base are released from the maxilla with the incision extending into the vestibule. As the lip and alar base move in and forward, the vestibular defect opens and flap l is used to fill this raw area and reduce subsequent contracture.

Of course, the right side is handled like the left including the paring of flap l, the freeing of the lateral lip element from the maxilla, release of the alar base by extending the lateral incision into the vestibule and finally the paring of flap b.
Paring the right upper vermilion flap to a superior base on the mucoperiosteum of the alveolus.

Extending the incision for releasing the lateral lip and alar base from the maxilla along the intercartilaginous line in the vestibule.

Flap b, as on the left, is cut slightly longer than half the cupid’s bow so the excess will pile up in the center to form a tubercle.
PREPARING THE PROLABIUM

In order to shape a philtrum and to set aside future columella tissue, the prolabium must be "drawn and quartered."

The objectionable inferior vermilion of the prolabium is turned down as a cuff (e) to serve as hidden lining to the central free border of the lip. Enough base attachment to the prolabium must be maintained for flap e's viability.

A 3 mm. edge of vermilion along the sides of the prolabium should be retained as a fringe on each fork to supply better cover during the banking. It will also provide extra tissue in a hidden position for the new columella. When this posterior edge is sutured to the membranous septum during the final advancement of the forked flap, it will be out of sight. All extra mucosa m is left attached to the premaxilla to assist in the formation of the posterior side of the upper labial sulcus.

The three fingers of prolabium, the central philtrum with its vermilion cuff e and the two lateral forks with their vermilion edge are dissected from their attachments to the premaxilla up to the nasal spine.
Flap e of inferior vermilion is being dissected from the prolabium.

The dotted line marks the future division of the prolabium from the premaxilla. Enough intact mucosa must be left above this line to vascularize flap e.

The tripartite prolabium philtrum with its mucosal cuff and the two forks are being dissected from the premaxilla leaving the peripheral mucosa m for cover of as much alveolus raw area as possible.
First one flap 1 and then the other is sutured into the raw area created by release of the lateral lip elements and alar bases from the maxilla. The extension of the releasing incision in the lateral vestibule up along the intercartilaginous line crosses and relieves the web of tightness. Introduction of flap 1 into this gap to whatever extent required bypasses the need of a vestibular Z or skin graft now or later. Not only are both alar bases free to move forward and inward but in the wake of their movement lining flaps ensure that they maintain the gain.
Flap 1 (Rt) is being sutured into the alar base releasing defect.

The same is being done on the left.

Both 1 flaps now line their respective vestibular defects.
Scoring the division of the left alar base from the lateral lip element.

Trimming the left lateral skin edge.

Tidying the right skin edge of the lateral element.

Dividing the alar base from the right lateral lip element.

The skin edge of the lateral lip element is tidied to match exactly the corresponding pared edge of the prolabium. Then the alar base is severed from the lateral lip element with a circumalar incision to make possible its greater medial rotation and permanent maintenance of this position independent of the lateral lip element.
Freeing the skin along the cleft edge. Bringing the posterior mucosa of the lateral lip flaps together.

Pinning the upper lip to the septum at the nasal spine. The muscles have also been approximated in the midline.

The skin edge of the lateral lip elements is freed 2 to 3 mm. to allow eversion in the skin closure. Then the lateral lip elements are sutured to each other across the cleft over the premaxilla and under the prolabium. First the posterior mucosa and then the muscles are approximated. The central upper portion of this join is fixed with a 4-0 chromic catgut (Ethicon #752G) to the septum at the nasal spine.
Each full-bodied alar base flap is divided into two flaps, one a skin flap D and the other a deeper, subcutaneous flap d. The subcutaneous alar d flaps are sutured with 4-0 Vicryl (Ethicon #V-494G) or 4-0 chromic catgut (Ethicon #752G) to each other and the septum just above the nasal spine. This suturing swings the alar bases into normal position and ties them there. Thus, the abnormal width of the nose and the flare of the alae are reduced primarily, leaving alar base skin flaps free to assist in forked flap banking.

Next the posterior mid-vertical slit in the prolabium, which has been cut to dermis, is caught with a 5-0 Vicryl (Ethicon #V-493G) suture that then takes a bite across the muscles. The tying of this suture dimples the philtrum.
Alar base flap being divided in two—flap D and flap d.

Skin flap D and subcutaneous flap d being demonstrated.

The dimple stitch picks up dermis in the slit and sutures it down to muscle.

4-0 Vicryl suture pinning both subcutaneous d flaps to each other and the septum pulling the alar flare out of the alar bases.
Once the posterior mucosa has been approximated, mucosal turnback flap e and its base are incorporated in the inferior closure. Often only a small amount of e is required for lining and the rest can be scrapped. Now the bed along the inferior prolabium is open for the bilateral advancement of the lateral vermilion b flaps edged with a mucocutaneous ridge to form the cupid’s bow.

Incorporating the mucosa of flap e and its base for lining into the posterior inferior position of the center of the lip.

Suturing the skin of the prolabium to the lateral elements at key points with 6-0 silk (Ethicon #780G) sets up each peak of the bow. This allows each flap b to slide medially to overlap half of flap e and fill out the free border.
Key skin point of philtrum and lateral lip element are being sutured on the right at potential peak of bow.

Same on the left.

Excess of lateral vermilion flaps pile up to form a full central tubercle.

Mucocutaneous “white roll” ridge on the lateral vermilion flap b can be brought under the prolabium.

if the prolabium mucocutaneous junction is well enough defined it can be maintained and only vermilion brought below it.

The mucocutaneous “white roll” ridge can be brought in on flap b. If the mucocutaneous ridge along the inferior border of the prolabium is raised and definite, it should be preserved and the ridge on the lateral mucosal flap can be trimmed off. When the mucocutaneous ridge accompanies the lateral vermilion flap, the surgeon is free to shape the double arch of a true cupid’s bow along the inferior skin border of the prolabium.

The extra length of flap b beyond the length of half the cupid’s bow is designed to present an excess of vermilion tissue which piles up in the center join to form a full tubercle.
Banking the forks is achieved by suturing each alar base flap D to its respective fork and closing off all raw areas.

Now the forks are banked by suturing the alar base skin flap D to the corresponding prolabium fork, tip to tip and sides to sides. This creates two bizarre skin pyramids, better thought of as “praying hands,” which usually fold back into the nostril floor almost out of sight. If all raw areas are closed, although the flaps seem to settle and shrink, the tissue is there and our prayers answered when the time comes for its advancement during columella lengthening.
Final suturing is achieved with 5-0 chromic catgut (Ethicon #792G) and 6-0 (Ethicon #790G) in the subcutaneous tissue closure of the lateral lip and prolabium. Then 6-0 silk (Ethicon #780G) approximates the skin edges. The pyramid "bank" plugging the nasal aperture settles into the nasal floor without serious airway obstruction.
WHISKER BANKING

Although the "praying hands" position is good, I have tended to use the whisker position in many of the complete clefts. The bilateral circumalar incisions, which release the alar bases from the lateral lip elements and allow advancement of the flaring alar bases, also provide an opening in the subalar area for banking the forks. The advantages are not only the complete coverage of the fork's raw area but also the visible position of the banked material, which is easily reelevated and shifted like any forked flap into the columella. This at present is my favorite banking method for all cases.
THE present primary operative plan for a bilateral cleft lip involves three procedures: (1) myringotomy, (2) soft palate closure and (3) lip closure with fork banking.

If there is also an associated cleft palate, there is certain to be fluid in the middle ears. Thus, the otolaryngologist is scheduled to carry out bilateral myringotomy and insertion of tubes for open drainage. He will follow the course of his postoperative result. If the palate is cleft but the defect is not severely wide and the soft palate elements can be brought together without relaxing incisions or severe tension, then the cleft edges are split and the nasal mucosa, muscle and oral mucosa are sutured together in three layers. Finally, the bilateral clefts of the lip are closed bringing the lateral mucosa and muscle together behind the prolabium. Unless the premaxilla was extremely protrusive or did not respond to external pressure, there should not be great tension. The forked flap will have been banked either between the lip and nose in “whisker position” or sutured in a pyramid with the alar base flaps as “praying hands.” If the latter method has been used, the projections can often be coaxed to fall back into the nasal cavity or they will rise as tiny pyramids in the nasal floors. Although the appearance is odd, they do not seem to obstruct the nasal airway appreciably.

AIRWAY

At the completion of the operation the oral packing is removed and careful suction of blood from the nose, mouth and pharynx
is carried out, first by the surgeon and later through the endotracheal tube during extubation by the anesthetist. It is important to remember that the infant has been accustomed to breathing through a double cleft of the lip with the premaxilla projecting out of the way. The cleft in the palate has also presented a generous posterior airway. When suddenly the lip clefts are closed, the soft palate is closed and, to a minor degree, small tags are left in the nostril floors, there has been quite a reduction in airway.

The first postoperative precautionary measure is the placement of a 3-0 black silk suture in the tongue to give direct control during the early postoperative recovery from anesthesia and adjustment of the reduced airway. As soon as the infant is awake, coughing and breathing normally, this suture is simply cut and removed. As noted by F. X. Paletta of St. Louis University:

Babies with respiratory distress are placed in a hood for regulated vaporization with warm moisture and increased oxygenation.

The next postoperative consideration is wound protection, and this involves several aspects.

**TENSION**

At the end of the lip closure benzoin is painted on the cheeks and a Logan bow is applied with tape after the cheeks are pressed together with noticeable relaxation to the lip area. This limits some of the lateral pull against the wound from the muscles during crying and seems to be the best method of partially splinting the lip during the healing. The direct side-to-side closure of the mucosa and muscle of the lateral elements without involvement of the prolabium has taken much of the drag out of the tension. It is important, of course, that the infant not be allowed to turn over on his face as striking the Logan bow on the bed could be disastrous. When the infant is irritable and crying with straining on the wounds, then if feeding does not pacify, a suitable minimal dose of analgesic is given. Arm restraints to prevent flexion at the elbows, whether plaster of Paris, tongue...
blade slatted wraparound splints or just large safety pins, are important. One jerk of a finger hooked in the Logan bow or the mouth could disrupt the wounds.

**Wound Care**

At the end of the operation, with the Logan bow in place and the wound open, an *antibiotic ointment* such as Cortisporin is applied to the suture lines. An order is written for this ointment to be applied three times daily after feedings. The rationale is as follows: An ointment places a protective coating over the suture holes and along the wound edges, not only preventing nasal discharge from bathing these areas but keeping local bacteria from infecting the stitch holes while the foreign body sutures are in position. The old method of scrubbing clots and debris from the suture line with hydrogen peroxide had good intention but did not prevent the crust; it merely removed it—and painfully. If a clot does form, then, of course, it should be removed. The presence of the ointment keeps the sutures soft and facilitates their removal on the third or fourth day.

**Feeding**

Regular formula feeding by an *Asepto syringe with a rubber tube extension* is started as soon as the infant is awake and hungry. The nurse sits the patient upright with his head in her hand and slips the tube over the tongue, squeezing the amount of formula he is able to take. It is well to finish off each feeding with clear water through the tube of the Asepto to clean the palate suture line.

**Antibiotics**

Antibiotics are not used routinely following lip surgery. If the suture line at any time becomes even *slightly inflamed*, an antibiotic is given orally. If there is a temperature rise not accounted for by low fluid intake and even if the lungs are clear, an antibiotic is started.
HEMOGLOBIN

Surgery is not undertaken unless the hemoglobin level is above 10 gm. Bilateral cleft lip surgery ordinarily does not cause much blood loss, and even when combined with soft palate closure it rarely necessitates blood transfusion. Nonetheless, hemoglobin study, on the first postoperative day, is important to make certain that whatever loss was suffered has been tolerated. If the hemoglobin is severely low, a transfusion will be necessary to ensure the adequate healing; if it is moderately low, then iron in the form of Fer-In-Sol (iron drops) can be given.

DISCHARGE FROM HOSPITAL

The sutures are usually removed on the fourth postoperative day. The wounds receive their final application of antibiotic ointment to seal the suture holes. Then, as soon as the mother has been retaught to feed the baby with the Asepto syringe and feels confident to do so, she is allowed to take him home. Usually she does so on the fifth postoperative day, and the infant still sports a Logan bow and arm restraints. The infant is brought to the office after one week. If the tape is irritating the cheeks, the bow is removed. If not, the bow and arm restraints are removed the next week. The wounds are allowed to heal by themselves without interference with massage. There should be almost no tension on the skin wounds, and if all goes normally the scars will eventually be close to invisible.

The pyramids or whiskers of banked forks will settle into the nostril floor or sill. They must be kept clean and, although not a pair of cosmetic beauty marks, they will rest quietly until called upon to lift the nasal tip.
30. Personal Cases of Complete Cleft Lip Closure and Fork Banking

At six months of age this baby came from Italy after having used rubber band traction from a headcap on the premaxilla.

POLYP BANKING SHIFTING TO PRAYING HANDS

B.D. 1-31-72
F.H. No clefts
F.T. Uneventful
O.C.A. None

Age 6 months
One-stage cleft lip closure was done at age six months.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. The upper mucosa of the cleft edges of the lateral lip elements was taken as flaps bilaterally and inserted into lateral releasing incisions in the vestibules behind the alar bases.
3. Forked flaps were pared from the sides of the prolabium.
4. Lateral mucosa and muscles were joined in the midline across the cleft behind the prolabium in front of the premaxilla.
5. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
6. The alar bases were freed from the lip elements and had their tips denuded of epithelium so they could be sutured to each other with 4-0 Mersilene behind the columella with reduction in the alar flare.
7. There was no place for the forks, so they were rolled into tubes and tucked into the nasal floor.

One fork was content to hide within the nostril, but the other (right) persisted in hanging out polyp-like. When the hard palate was closed, the fork polyps were opened up and joined to alar base flaps in the delayed "praying hands" position in preparation for columella lengthening before school age. This ended the polyp-type banking in the primary procedure. Forked flap advanced one week ago.
COMPLETE CLEFT, FIRST STAGE;
FORK BANKED AS PRAYING HANDS

The patient was first seen at two months of age with premaxilla firm and forward.

Elastic traction was used for one month. Then myringotomy was done with bilateral tube insertion, soft palate closure and first-stage lip closure with banking of forked flap.

1. The prolabium was pared laterally as a forked flap and freed from the premaxilla up to the nasal spine.
2. U-shaped vermilion of the prolabium was left attached to the premaxilla to cover the raw anterior area.
3. The lateral lip elements were freed from the maxilla. The alar bases were further freed by incisions in the vestibule extending up and medially along the intercartilaginous line.
4. Upper lateral edge vermilion flaps were sutured into the vestibular defects.
5. The lateral lip elements were brought together in the midline joining both mucosa and muscles.
6. The prolabium was set between the lateral lip segments with a dimpling stitch.
7. The remaining lateral vermilion flaps carrying a mucocutaneous junction ridge were sutured over the turndown flap of vermilion along the inferior edge of the prelabium.
8. The alar bases were freed from the lateral lip elements by circumalar incisions. Then subcutaneous flaps were dissected from under the alar base flaps and sutured to each other at the septum, reducing the alar flare.

9. The alar base skin flaps were sutured to the forked flap as a banking procedure.

Advancement of the banked fork into the columella and reduction of alar flare will be done at about five to six years.

PREMAXILLA SETBACK, LIP CLOSURE, AND PRAYING HANDS BANKING

Like the first case in Chapter 17, this infant shows bilateral complete clefts of the lip and projecting premaxilla with no cleft of the hard or soft palate.
1. A longitudinal incision was made in the mucoperiosteum covering the septovomerine stalk with subperiosteal dissection and resection of a 0.5 cm. square block of bone between the premaxilla and the swelling in the vomer. The mucoperiosteum of the sides of the premaxilla and the maxillae was turned as flaps. Then the premaxilla was set back in undercorrected position with a 3-0 chromic catgut suture between premaxilla and vomer, followed by suturing of the mucoperiosteal flaps of the premaxilla and the lateral maxillae for total closure.

2. Forked flaps were pared from the sides of the prolabium.

3. The lateral lip elements were freed from their attachments to the maxillae.

4. Excess mucosa along the cleft edges was turned as 1 flaps to fill releasing incisions in the vestibule used to free the alar bases.

5. The prolabium was elevated from the premaxilla.

6. Lateral vermilion of the prolabium was used as flaps to cover the raw anterior surface of the prolabium.

7. The lateral lip elements were sutured to each other behind the prolabium.

8. The lateral muscles were sutured together.

9. The prolabium was replaced as philtrum with a dimple stitch.

10. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the turndown vermilion flap of the inferior prolabium.

11. The alar bases were cut as flaps.

12. The forked flaps were sutured to the alar base flaps in a handshake type of "praying hands" banking.
STRETCHING THE PROLABIUM FOR SECONDARY BANKING

Here is a baby boy born with the bilateral cleft of the lip and palate too late to be included in my regular statistics. Because of the pea-sized prolabium, it was decided to attach the lateral lip elements to the sides of the prolabium in a glorified adhesion using the standard lateral vermilion flaps edged with the mucocutaneous ridge to overlap the prolabium vermilion. By not joining the muscles to each other across the midline, they were free to tug and stretch the tiny prolabium.

By 18 months of age, there was enough tissue to spare a forked flap that was banked in whisker position. The tailored prolabium was elevated, the lateral lip musculature joined in the midline and the prolabium replaced with a dimpling stitch. At age 4 to 5 years, the forked flap will be advanced into the columella.
31. Banking and Cashing the Forked Flap

Once the excess prolabium skin has been moved out of the lip and stored for later use, the lip need not suffer reentry and the lovely scars of infancy can be retained forever. Whether the forked flap has been banked as tubed polyps hanging free or, better, in subalar whisker position, or in the floor of the nose clasped as “praying hands” pyramids with the alar base flaps, as long as all raw areas are covered the tissue may settle but will remain available.

Popping Polyps

In some cases, once the alar bases had been advanced medially and fixed, there seemed to be no place to bank the fork. Each prong of the fork, therefore, was tubed on itself and left dangling as polyps. This was an annoying temporary deformity which invariably was corrected by another surgical stage of opening the polyps and approximating them to the alar base flaps in “praying hands” pyramids.

One method of banking tubes (each fork to form a pair of polyps). For better banking, these polyps can be opened and the alar base flaps D elevated. Then each fork is sutured to each flap D in the “praying hands” pyramids.
Finally, a method was developed and has been described which allowed deep advancement of the alar bases but still supplied alar base flaps for banking the forked flap.

The second-stage columella lengthening calls first for freeing the forks by parallel anterior and posterior incisions. The anterior incisions run in front of the forks to join across the base of the columella in an inverted V while the posterior incisions extend behind the forks in the nasal floor to join and continue through the membranous septum, up over the septal tip and on to the bridge for about 0.5 cm. with lateral extensions in the vestibule to ensure full nasal tip release.

**SHIFTING WHISKERS**

If the forked flap is in whisker position, the prongs are cut out of the upper lip, sutured together, tubed in its upper portion, advanced along the septum and fixed with sutures. The tips of the fork are splayed as a columella base to meet the advancing alar bases.
Making the membranous septal incision.

Freeing the forked flap along the septum at the tip.

Forked flap c, c free up to the tip.

Alar base flap D being freed.

Tip of alar base flap D being de-epithelialized for suture to its mate of the opposite side at the base of the septum.

Tubing the posterior aspect of the forked flap.

Suturing the anterior skin of the forked flap.

Resultant lengthening of columella well over 1 cm.

Placing the key suture through the denuded tips of the alar base flaps D and the base of the septum.

Tying the suture with medial advancement of the alar bases.

Subcutaneous suture of the alar bases to the lip.
OPENING HANDS

If the forked flap has been placed in apposition with the alar base flaps in the "praying hands" position, these two components are cut as two humped straps. Anterior incisions made along the front of the alar bases and forks meet in the midline at the base of the columella in an inverted V. Parallel with these anterior incisions are posterior incisions inside the alar bases, across the nasal floors, up the membranous septum and over the septal tip. Thus are created two strap flaps, each with a central pyramid which, when dissected partially open, lengthens the strap as would happen if the hands were pulled apart at the palms but allowed to retain contact at the fingertips. These elongated straps are advanced medially to each other and upward along the septum into the columella in the rotary action similar to the
Carter-Cronin motion. The join of the tips of the fork to the tips of the alar base flaps has been maintained and forms a slight swelling which, after medial advancement, imitates the medial alar cartilage feet at the columella base.
Forked flap portion of the D-c strap flap is being advanced into the columella as the nasal tip is elevated.

Deep subcutaneous suture approximating the fork at the base of the new columella is placed.

The first loop is thrown and tied.

Skin sutures have been placed.

If nasal floors are too wide, wedge excisions can be used.

Columella lengthening without lip reentry.
PERSONAL CASES

Asymmetrical incomplete clefts

At four and a half months of age, one-stage lip closure was undertaken.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Lateral mucosa and muscle were joined behind the prolabium.
4. A dimple stitch was made.
5. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
6. The forked flap was banked with the alar base flaps in "praying hands" pyramids.
Three and a half months later, at age eight months, the forked flap was advanced into the columella with nasal tip release and alar base advancement.
At three months Fred Pullen performed myringotomy with insertion of ear tubes. This was followed by soft palate closure and first-stage lip closure with banking of forked flap.

1. The alar bases were freed from the maxillae by dissection, and further release was achieved by incisions in the lateral vestibular lining. Lateral vermilion flaps 1 were used to fill the vestibular defects and allow the nose to come and stay forward.

2. A forked flap was pared from the sides of this tiny prolabium, and the prolabium was freed from the premaxilla up to the nasal spine.

3. The lateral prolabium vermilion was left attached to the premaxilla to cover its raw surface.

4. The lateral lip elements were brought together in the midline, with suturing of the posterior mucosa and the muscles.

5. The prolabium was brought back into the center of the lip, and a dimple stitch from prolabium dermis to the muscles fitted it in position.

6. Lateral vermilion flaps carrying the mucocutaneous junction ridge were brought together under the inferior border of the prolabium overlapping the turndown flap of prolabium vermilion.

7. The alar bases freed by circumalar incisions were divided into a deep subcutaneous flap and a skin flap. The subcutaneous
flaps were sutured to each other at the septum to correct the alar flare.

8. The forked flap was sutured to the alar base skin flaps in “praying hands” pyramids.

At 3½ years the patient was brought back from Japan for the banked fork to be shifted into the columella for tip release and for right-sided lip lift.
A disadvantage of the praying hands banking, besides slight shrinkage of the flaps, is that little additional tissue can be added to the fork at the time of columella lengthening. Lip will require further lift on the right side when final scar and nasal revisions are done.

Complete clefts except for tiny right Simonart's band

At five months of age one-stage lip closure was performed.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Lateral mucosa and muscle were united behind the prolabium.
4. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion. The prolabium mucocutaneous ridge was vague.
5. The forked flap prongs were tubed slightly and then let into the incision between lip and alar base in whisker position.

Three months later, at eight months of age, the forks were advanced into the columella with the aid of a membranous septal incision. The alar bases were advanced medially.
Comment. In spite of early columella lengthening, lip did not lengthen too much in vertical dimension.

Again, an early cartilage strut would have offered a supportive advantage.

Asymmetrical incomplete and complete clefts

Elastic band traction from headcap was used to restrain the premaxilla. At two months of age one-stage lip closure was done.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium including some Simonart’s band on the right.
3. Lateral mucosa and muscle elements were sutured together in the midline behind the prolabium.
4. A dimple stitch was made in the prolabium.
5. Lateral vermilion flaps carrying the mucocutaneous junc-
tion ridge were used to overlap the prolabium vermilion.

6. The forked flap was sutured to the alar base flaps in a “praying hands” pyramid.

At four months of age the forked flap lengthened the columella.

Columella lengthening was effective, but early action in this regard ended up with a lip too long vertically and some retraction of the columella. This result stimulated the use of transverse upper lip flaps based on the alar bases and transposed behind the columella into a membranous septal releasing incision with correction of columella retraction and lip length.

Comment: Early columella lengthening at 4 months resulted in long lip. Time and growth should improve the nose.
Complete clefts (except for tiny Simonart’s band)

B.D. 12-29-71
E.H. No clefts
E.T. Uneventful
O.C.A. Hydrocephalus

Rubber band traction from headcap was used against the projecting premaxilla. At six weeks of age one-stage bilateral cleft lip closure was carried out.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Upper mucosal flaps from the lateral cleft edges were inserted into the vestibular alar base releasing incisions.
4. Lateral mucosa and muscles were united in front of the premaxilla behind the prolabium.
5. The alar bases were freed from the lip elements, denuded of epithelium at their tips and sutured to each other on the septum behind the columella with Mersilene.
6. A dimple stitch of Mersilene was made in the prolabium.
7. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
8. The forks were rolled on themselves and set into incisions between the alar bases and the lip as a whisker-style banking.

10-6-72. Myringotomy, suction and tube insertion by F. Pullen; soft palate closure

2-10-72
Lip healed with good muscle continuity and forked flap remained banked as whiskers until four years.

A 1976 shift of forked flap from whiskers to columella

At four years, and at the same time as the hard palate closure, the forked flap was shifted into the nose. A semi-cine of the profile action shows the forked flap marked, elevated out of the whisker position in the lip, united in front with 6-0 silk, rolled into a column behind with 4-0 chromic, rising free with release of the snubbed tip by a membranous septal incision and advanced into the columella with its tips splayed at the base.
Subcutaneous extensions of the freed alar bases were sutured to each other on the septum at the nasal spine with 4-0 Mersilene to correct the alar flare. This action so reduced the width of the nasal base as to leave a discrepancy with its longer matching edge along the defect in the upper lip. It has been found, however, that the discrepancy can be accommodated as the lip is lifted back up to the nose and the airways can be maintained at the same time.

The use of 4-0 chromic catgut mattress sutures passing from inside the floor of the nose out to pick up the muscle of the lip and back again inside the nose can force a matching of edges which 6-0 sutures in the skin can finish neatly.

5 days after advancing fork
Elastic traction on headcap was used for positioning the pre-maxilla. At six weeks of age bilateral cleft lip closed in one stage.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Mucosa and muscles were united behind the prolabium.
4. A Mersilene dimple stitch was made.
5. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
6. The forked flap was banked in subalar whisker position.
11-21-72. Myringotomy, suction and tubes inserted, soft palate closed

Comment: Good lip with continuity of mucocutaneous ridge

3 months postoperative

10 months of age

3 years

At age $4\frac{1}{2}$ years, forked flap was advanced from whisker banking position into the columella to release the nasal tip. This patient started with no columella and only a moderate sized prolabium. The early postoperative pictures and the later color page vindicate this compromise of sharing the prolabium as he now has a good philtrum and plenty of columella.

Comment: Note continuity of the mucocutaneous ridge.

3 months after advancing fork

An advantage of the whisker banking, besides preservation of the fork, is that extra tissue can be incorporated secondarily in the fork if necessary at the time of the advancement.
Elastic restraint from headcap was used against the premaxilla. At age three months, one-stage lip closure was accomplished.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Lateral mucosa and muscles were joined in the midline behind the prolabium.
4. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
5. The forked flap was sutured end to end with the alar base flaps in "praying hands" banking.

S.P. 5-9-72, Soft palate closure.

Comment. Cupid’s bow is too wide.
At 5 years of age the premaxilla was set back by subperiosteal block wedge resection of the vomer and fixation with a Kirschner wire and tray splint by Berkowitz.

Six months later the forked flap banked in praying hands position was redeveloped by parallel incisions, opened for lengthening and advanced into the columella with the aid of a membranous incision. The alar bases with subcutaneous extensions followed in the wake of the forks and were sutured to each other at the nasal spine to narrow the nose and elevate the tip.
Rubber band traction from headcap was used against the premaxilla for two months. At age two months one-stage lip closure was undertaken.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Lateral mucosa and muscles were united across the cleft in front of the premaxilla behind the prolabium.
4. A Mersilene dimple stitch was made in the prolabium.
5. Alar base flaps were freed from the lip elements, denuded of epithelium at their tips and sutured to each other on the septum behind the columella to reduce and prevent alar flare.
6. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
7. The forks were rolled on themselves and sutured tip to tip in front of the columella.

At one year of age the soft palate was closed, and at the same time the fork polyps were opened and sutured to the alar bases in the "praying hands" position. After one other such case, the polyp-like banking was discontinued and the "praying hands" or whiskers type preferred.

At 4½ years the banked fork was advanced into the columella.
Comment. Note good lip, continuity of mucocutaneous ridge, position of alar bases and columnella length.

Elastic band traction from headcap was used against the projecting premaxilla. At two months of age one-stage lip closure was done.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Lateral mucosa and muscle were joined behind the prolabium.
4. Lateral vermilion flaps carrying the mucocutaneous junction ridge were used to overlap the prolabium vermilion.
5. The forked flap was sutured to the alar base flaps in "praying hands" pyramids.

B.D. 1-7-70
F.H. No clefts
F.T. Uneventful
O.C.A. I.Q. 53

4½ years

Complete clefts

3-4-70. Lip closure
Five months later, at age seven months, the forked flap was advanced into the columella with release of the nasal tip. At this time prolabium skin was elevated from above, and deep tissue was removed from the center of the philtrum and a dimple stitch placed.

A temporary homologous septal cartilage strut inserted behind the forked flap into the nasal tip would have maintained better support. An autogenous strut will be used at 15 to 16 years.
Rubber band traction from headcap was used against the projecting premaxilla. At two months of age one-stage lip closure was carried out.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Lateral mucosa and muscle were joined behind the prolabium.
4. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
5. The forked flap was sutured to the alar base flaps in "praying hands" pyramids.
6. The soft palate was closed.

9-23-70. Forked flap

At three and a half months of age the forked flap was used to lengthen the columella.

Comment: 1. Very early columella lengthening with only slight lip lengthening
2. Bifid nasal tip still needs corrective surgery.
At three months of age one-stage lip closure was done.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the edges of the prolabium.
3. Mucosa and muscle of the lateral elements were sutured to each other behind the prolabium.
4. Lateral vermilion flaps were used to overlap the prolabium vermilion. The mucocutaneous ridge of the prolabium was retained.
5. The forked flap was banked whisker fashion between lip and alar bases.
At five months of age the forked flap was advanced into the columella.

Comment. No attempt at primary medial advancement and fixation of alar bases resulted in final flare requiring later reduction. Early forked flap without getting long lip.

An autogenous septal cartilage strut in the columella will eventually perfect this result.

Complete clefts
At three months of age one-stage lip closure was carried out.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Mucosa and muscle of the lateral elements were united behind the prolabium.
4. A dimple stitch was placed.
5. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
6. The forked flap was banked with the alar base flaps in "praying hands" pyramids.

At six months of age the forked flap and alar bases were advanced to lengthen the columella and position the alar base.

The columella was thinned by a vertical diamond excision.
Rubber band traction from headcap was used against the projecting premaxilla. At six weeks of age one-stage bilateral cleft lip closure was accomplished.

1. The prolabium was freed from the premaxilla, and the lateral lip elements were freed from the maxillae.
2. A forked flap was pared from the sides of the prolabium.
3. Lateral mucosa and muscles were united in front of the premaxilla behind the prolabium.
4. A dimple stitch of catgut was made in the prolabium.
5. Lateral vermilion flaps carrying the mucocutaneous ridge were used to overlap the prolabium vermilion.
6. The forked flap was sutured to alar base flaps in “praying hands” pyramids.

S.P.
5-10-72. Soft palate closure

7 months postoperative
2 years old
At 5 years of age forked flap banked in praying hands position revealed right fork but the left fork had faded into the floor of the nose. Parallel incisions and development of the forked flapalar base strap with the aid of a membranous septal incision allowed some release of the nasal tip and lengthening of the columella without lip re-entry.

Comment. Further columella lengthening will be required later.
Revising the early fork

When the forked flap was advanced into the columella during the first year of age, often (but not always) there was a tendency for it to be dragged partially back down into the lip and spread in width. At the same time and probably because of the same principle of muscle pull, as the child tugs the freed prolabium over the projecting premaxilla the lip increases in vertical length. A child successfully carrying out this action is shown. Although not the ideal situation and to be avoided if no other aspects of progress are lost, these minor deformities can be corrected quite easily when the child is older by simple revision. Here is a case in point.

A baby boy born in 1959 with bilateral CLP and protruding premaxilla had a complete cleft on one side and an incomplete cleft on the other. At three months of age a one-stage straight-line closure of both sides was obtained with lateral vermilion flaps overlapping the prolabium vermilion. Three months later, at age six months, a forked flap was advanced into the columella. Then followed the rather typical spread of the columella and partial drag of the forked flap back down into the lip along with some vertical lengthening of the lip.
On June 24, 1966, at age six and a half years, the forked flap was thinned and repositioned and the lip shortened by high transverse excision and suture including one midline wire suture of lip to septum.

*Cartilage support for the forked flap*

Since the skin flaps advanced into the columella in front of and above the septum for release and elevation of the nasal tip are only soft tissue, maybe it is not surprising that they have a tendency to sag. Of course, the vigorous muscle pull of the lip is no ally. A septal cartilage strut would support and maintain the raised nasal tip, but to take the septal cartilage in infancy or childhood is unwise. For this reason I had accepted the slight sag of the tip, widening and retraction of the columella and sliding of the tails of the forked flap back into the lip. With the anticipation that these little problems could be corrected without difficulty at age 16 years and then safely maintained with an autogenous septal strut at that time, I had postponed early support.
Oneal's suggestion of temporary homologous cartilage support during the primary columella lengthening makes good sense. It would seem that banked uncarved but sliced homologous septal cartilage would serve exceptionally well as a temporary supporting strut during the primary columella lengthening and tip elevation at preschool age. This effect would last for years and possibly until autogenous septal cartilage could come to the rescue if that were ever necessary.

CONCLUSION

In an attempt to avoid the columella drag and lip lengthening following early forked flap advancement, the forked flap is now banked until school age and then shifted into the columella and sometimes supported with a banked septal cartilage strut. Long-term experience with various banking maneuvers at present has made the whisker position the favorite because of less shrinkage over the years and ultimately easier recutting and shifting of the fork under direct vision. It is too soon to tell whether the same secondary deformities will occur, but they probably will not. Should they appear, however, revision is not difficult and concern about it in no way justifies retaining a flat nasal deformity into school age.