II. The Evolution
Introduction to Part II

Through the ages the anomaly with its variations and the surgeon’s ultimate goal of the normal have remained essentially the same. With the advances in anesthesia, fluid replacement and chemotherapy, such distractions as mortality, morbidity and wound disruption have been reduced to nil. The surgeon has thus been set free to concentrate on the discrepancy between his results and the normal and to devote more time to the detail of closing this gap.

In 1971 David Davies, for the Melbourne International Congress Transactions, summarized the unilateral cleft lip surgical family tree to chart the evolution of its progress. He included the main branches with 16 legitimate offspring and one bastard, leaving out many good and some bad for the sake of simplicity.
Although I do not agree entirely with his "tree" format or the position of rotation-advancement, the only changes made in Davies' chart are the addition of his own name, which he modestly omitted, and the blackening of Owen's. The rest of this volume will be devoted to rearranging the branches, adding others, covering them all with leaves and finally collecting and comparing the fruit.

In following the line of progress in the evolution of cleft lip surgery with all its bifurcations, detours, lay-bys, shortcuts and breakthroughs, we are certain of one fact: The progress has not proceeded in a precise chronological order. Rather it has been a haphazard chain reaction, sparking here and there, with one idea setting off another but not always in a forward direction. A more primitive approach was being modified while more advanced methods had been in use for years. To understand what has occurred, it is necessary to follow each fundamental principle from its conception to its perfection. When its highest potential still fell short of the ideal normal, it was time to discard it and usually this is what happened. The motivation that forces the discarding of familiar inferior methods is the frustrating dissatisfaction suffered by the surgeon with the result of his or others' methods. This is the stimulus that is constantly firing the search for a better way.
6. Paring and Approximation with Needles and/or Sutures

It is not known for certain who was the first to operate on a cleft of the lip. There have been inferences that Aurelius Cornelius Celsus, a Roman physician of the first century A.D., was the first, but no real proof has ever been cited.

CLEFT LIP SURGERY IN THE CHIN DYNASTY

Translation by Khoo Boo-Chai, of Singapore, of the Chin annals compiled in the early part of the Tang Dynasty reveals what must be the first cleft lip surgery described in world literature. It seems that Wei Yang-Chi, a Chinese farmer’s son, was born with a harelip (T’u Ch’ueh) deformity. Boo-Chai commissioned artist Steve Lu to illustrate young Wei in typical fourth-century Chin Dynasty plain peasant dress.

In about A.D. 390 of the Chin Dynasty an unusually astute fortune-teller studied Wei’s palm and predicted wealth and honor for the boy. At age 18 Wei took what rice he could carry and set out to see Governor Yin Chung-K’an. The governor was impressed with this lad and called in one of his physicians who specialized in lip clefts. The cleft surgeon took one look at Wei and explained:

I can cure your condition by cutting and stitching the edges together. However, after the operation it will be necessary for you to rest the affected
part for 100 days. During this time you can ingest only thin gruel and you cannot smile or talk.

Wei replied:

What is 100 days to me when for relief of my condition I would remain silent for half a lifetime.

The operation was done, and Wei kept his word by keeping his mouth shut for 100 days. After this, as could be predicted, he prospered, eventually becoming the governor general of six provinces and being honored by his emperor with an ancient order. Wei is shown here many years after the operation and clothed by Lu in an official ornate governor's gown.

Sometime during the Tang Dynasty (A.D. 618 to 907) Fang Kan gained considerable fame as "the doctor of lips."

FROM THE LEECHES THROUGH THE MIDDLE AGES

We are all indebted to our walking plastic surgery library, Blair O. Rogers of New York University Medical Center, for his intellectual curiosity and ability to extract important historical data from the world literature. Along with Plastic and Reconstructive Surgery Editor Frank McDowell, Associate Editor Robert Goldwyn and others, he has made it possible to piece together the early history of clefts.

THE LEECHES CLOSED LIP CLEFTS

The Saxon surgeons of pre-Norman Britain, known as "leeches," are the next group of specialists to describe surgery of the cleft lip in Europe. The principle of early cleft lip surgery from the time of the leeches through the Middle Ages and, in fact, well into the eighteenth century was directed toward simple freshening of the edges of the cleft and approximation of these edges until firm union occurred. In the Leech-Book of Bald, about A.D. 950, the operation is described simply:
For hairlip, pound mastic very small, add the white of an egg and mingle as thou dost vermilion, cut with a knife the false edges of the lip, sew fast with silk, then smear without and within with the salve, ere the silk rot. If it draw together, arrange it with the hand; anoint again soon.

**THE METHOD OF CAUTERY**

In the original Sanskrit text of the Susruta Samhita, methods of cauterization of wounds were described. Based on this the Hindu surgeons of the sixth or seventh century B.C. used burning devices and handed their techniques down through the centuries. About A.D. 1000, Albucasis, the greatest surgeon of the Arabian school, used cauterization of wound edges. It is not known for certain that he applied this method in cleft lip, but it is likely that he and other Arabian surgeons as well as those influenced by this school employed the cautery approach in preference to the knife because of the reduced bleeding. Turkish surgeons five centuries later still preferred cautery as have surgeons of many other nations.

**FLEMISH FIGURE-OF-EIGHT**

In the early part of the fourteenth century, the Flemish surgeon Jehan Yperman first described in detail the repair of both unilateral and bilateral clefts of the lip. As noted by Rogers in 1964, Yperman actually sutured the edges of the freshened borders of the cleft lip by using a triangular needle threaded with a twisted wax suture and reinforced this closure with a long needle passed through the lip some distance from the edges of the cleft in order to make a more accurate approximation. This latter needle was held in place with a wraparound figure-of-eight thread. Yperman mentioned that some surgeons of his era used relaxing incisions externally in the cheeks to close very wide clefts, but he himself refrained from this procedure because of the facial disfigurement which might “compromise the reputation of the surgeon.”

During the fourteenth century it was probably the barber-
surgeons of England who passed on the skills required to repair clefts of the lip.

**INTERRUPTED SUTURES**

Heinrich von Pfolsprundt, a Bavarian army surgeon, in his 1460 book, *Buch der Bundth-Erznei*, described cleft lip closure using a razor or scissors to freshen the edges and the placement of sutures through the entire thickness of the lip. Over this he applied a plaster containing a red healing salve which was changed twice a day until the wound was healed in three weeks.

About 1530 Hieronymus Brunschwig, an Alsatian army surgeon from Strasbourg, strapped his cleft lip patients to a table with towels, freshened the cleft edges with scissors and achieved union by interrupted waxed silk sutures reinforced with a pinching clasp dressing or a self-retaining clasp. The wound was anointed with a thick paste made of powder of eggshell chalk and egg, and a cloth was wrapped over the entire wound, face and neck, the bandage being looped under the arms in a Roger of Salerno twelfth-century dressing.

**FRANCO AND PARÉ**

In the sixteenth century two gifted Frenchmen made contributions to this surgery. Pierre Franco in 1556 described the operation in detail, and Ambroise Paré in 1568 first illustrated the procedure. These two Huguenots are inevitably coupled. Franco was the senior but a student of Paré. Paré was the more influential, serving as surgeon to four kings, while Franco worked in the provinces or in exile. It is true that even today Franco’s name is mentioned only by the specialists; Paré is known by everyone. After much research, Barsky suggests that Franco developed the early surgery of cleft lip of his day whereas history has recorded it mostly as the work of Paré. Yet the contributions of each had much influence on surgeons in the centuries to follow, and undoubtedly Paré’s writings and illustrations had the most far-reaching effect.
Franco wrote in 1556:

The entire skin margins of the cleft which are to be joined must be cut with razor or scissors, or [seared] with the cautery. Then put on dressings to ease the pain and leave them for one or two days . . . if cautery is used . . . the eschar [is removed]. . . . After this is accomplished, the margins must be brought together so that . . . no portion of one . . . does not touch the other. This can be done in two ways, one with needles . . . and the other with pieces of cloth triangular in shape . . . made adherent with a special ointment including egg albumin to the cheeks on each side of the cloven lip. By suturing the points of the cloth together the edges of the cleft are brought into apposition.

This was before the advent of anesthesia, and Franco partly explains that the adhesion method is preferable because of:

caus[ing] the least pain and the least scarring.

He also had the ingenuity to free the lip elements from their attachments to the upper jaw to ease the closure in wide clefts. This principle was enhanced by Dieffenbach in 1830 with wide undermining and lateral cuts under the nostrils well out into the cheeks and in modified forms is still used in many clinics today.

Ambroise Paré, son of a cabinetmaker, at age 16 learned the rudiments of surgery from Jean Vialot, the barber of Laval. He then became a surgical resident for three years at Hôtel-Dieu and during this time contracted bubonic plague. Paré not only survived with a few scars but lived to be 80. His next surgical experience came while he was in the army. Lack of formal education enabled Paré to bypass superstitions of his dark age and find truth by observation and experience. He said, “Surgery is an art,” and set five proper duties of a surgeon which are actually the first published plastic surgical principles!

To take away what is superfluous.
To restore to their places things which are displaced.
To separate those things which are joined together.
To join those which are separated.
To supply the defects of nature.
Paré pared the edges of lip clefts but preferred closing the cleft by transfixing the lip elements with a needle and fastening it with a figure-of-eight wraparound thread. He wrote:

Wherefore you must use a three or four square needle . . . being thred with a waxed thred; and with this you must thrust through the lips . . . and leave the needle sticking in the wound, then wrap the thred to and again over the ends thereof eight or ten times, just after the manner which women use to fasten a needle with thred in it, upon their sleeves, or Tailors to their hats or caps, that they may not lose them. The needle thus fastened shall be there untill the perfect agglutination of the wound; this kind of suture is used in . . . harelips, for so we commonly call lips which are cleft from the first conformation in the wombe by the error of the forming faculty.

A ROYAL COMPENSATION

According to the research of Nagdy Saad and John Barron of Salisbury, England, both Paré and his Oeuvres, published in 1575 and containing much of the information on Paré, were saved by a king. During the terrible 1572 massacre of St. Bartholomew's Night instigated by Catherine de'Medici, Paré narrowly escaped death. King Charles IX, exclaiming over the shame of the loss of the life of one who had saved so many lives, hid the Huguenot in his royal chambers until all other heads had rolled.

TAGLIACOZZI

Gaspar Tagliacozzi of Bologna qualified in medicine in 1570 and probably studied under Paré as he often referred to Paré in his writings. By 1597 Tagliacozzi was excoriating the cleft edges and stitching them together with interrupted sutures. He wrote:

Let the Artist therefore take up that part of the Lip, which must be excoriated, in his Left Hand, and then take off the Skin equally with a very sharp Knife, till the Blood comes, to the very Angle of the Hiatus. . . . This Operation may also be performed very quickly and safely with a pair of Scissors. The same must be done on the other side. Then we must draw the parts together with the Hand, and stitch them. We must observe this, not to take our stitches superficially, but through all. The Artist must
therefore pass his Needle straight through the Lip from outside inwards, and on the other side he must pass the Needle from the inside outwards. He must tie the threads . . . and then cut them off . . .

RETENTION BANDAGE

Hieronymus Fabricius of Padua, a pupil of Fallopius and teacher of Harvey, about 1600 advised use of buccal mucosa and tissue from the alveolus in closing clefts of the lip. If the cleft was wide, Fabricius used an agglutinative bandage to bring the edges of the cleft together before he began freshening the margins and inserting needles, the ends of which he bent over after having passed them.

GERMAN TEXTBOOK

In the most popular surgical work of the eighteenth century, the German surgeon Lorenz Heister in his *Chirurgie* recounted:

Many German Quacks and Mountebanks frequently retain the Lips of the Wound together by strong Thread passed through them instead of Needles, after which they tie the Ends of the Thread in the same manner as we directed for the knotted Suture in Part I, Book I, Chapter VI . . . and thus they succeed, and perform good Cures, though in an awkward manner, and by obtuse and unfit Instruments, especially when the Fissure is but small, for when it is large this method will hardly succeed.

COLONIAL AMERICA

From newspaper reports, scholarly Blair Rogers has pieced together cleft lip work in colonial America.

On Friday, September 1, 1770, in the Boston *Evening Post*, there was an interesting item:

A few Weeks since the Operation for the Hare-Lip was performed to great Perfection on a young Man in Milton near Brush-Hill; and a Child in Boston has received as much Benefit from the Operation as the Case would admit of by Mr. Hall, Surgeon of the 14th Regiment.

These were exciting times in more than one way in America.
In April 1775 silversmith Paul Revere made his famous midnight ride. Just one month later, in May 1775, rivaling Revere’s news, an advertisement was placed in a Philadelphia paper by “Dr.” Anthony Yeldall with testimony from one of his patients’ parents:

For the benefit of others, be it made public, that I John Dunbar, of the City of Philadelphia, had a daughter with the deformity of a Hare-Lip; I then applied to Dr. Yeldall, who, to my satisfaction, did the operation in one minute, by the watch, and compleated the cure in four days.

   John Dunbar

None need despair, having the above mentioned deformity, for let them be ever so large or frightful, or have been cut ever so often before, they will be done in one minute, and the cure compleated in four days, or nothing will be required. Poor people may have them done GRATIS.

   Dr. Anthony Yeldall

On March 29, 1780, in New London the Connecticut Gazette published the following advertisement:

Lawrence Stork, From Germany, Informs the Public, That he undertakes to cure . . . hair-lips . . . and he further informs, that if he makes no cure, he expects no pay. He may be seen at Mr. Jacob Fink’s in New London.

In a more traditional style, Matthew Wilson, a minister and physician from Pennsylvania practicing in Delaware, wrote an unpublished compendium of medicine from 1765 to 1787 called the “Therapeutic Alphabet” in which cleft lip surgery is described in the quaint vernacular of that period.

Labium Leporinum: Hare lip. see Lagocheilos.
Lagocheilos: Harelip. Is a Deformity in which ye Lip is divided by Chasm or Fissures. . . . The Operation should be omitted, untill ye Child has some Reason to suffer it to be done. . . . Separate ye Lip from ye upper Jaw; divide ye Frenulum we connects it to ye Gums. If ye Dentes Incisorii too much projected, cut ym out in Infants. Cut off ye callous Lips wt Scissors ye whole length, but take Care to make ye Wound in Straight Lines. Then bring ye two Lips of ye wound exactly together, & pass a couple of pins, one pretty near ye Top & ye other as near ye bottome, thro’ middle of both edges of it, & secure ym in yt Situation by twisting a Piece of Wax’d thread, across & round ye pins 7 or 8 times. . . . In 8 or 9 Days ye parts generally are found united, yn gently extract the Pins and apply dry Lint
NEEDLES AND PINS, THREADS AND STITCHES

The eighteenth-century controversy over the use of harelip pins with the figure-of-eight wraparound thread versus interrupted sutures passing through the lip edges and tied across the cleft is reminiscent of controversies that have raged and will continue to erupt as long as surgeons are individuals free to seek and promote a better way. Often the new or unorthodox method is labeled quackery. It is true that untrained surgeons, often no more than quacks and charlatans, by their “unshackled” nature may in some small item supersede the staid, trained traditionalist. Yet, in time, the best methods by their results, regardless or in spite of the promoter, eventually win out.

It seems that the wraparound technique illustrated by Paré had more appeal to colonial surgeons such as Wilson than the more sophisticated suturing described by Tagliacozzi. Yet Heister considered the figure-of-eight wraparound thread, which had been the traditional cleft lip suture for four centuries, the more scientific. He accused quacks of using the interrupted sutures. We can surmise from Heister’s writing that Lawrence Stork probably used interrupted sutures rather than the figure-of-eight. Yet when we read how fast Yeldall could close a lip, we are prompted to think that, quack or not, he might have been using the figure-of-eight.

Certainly J. A. Pancoast indicated in 1844 that he was still paring the cleft edges in a straight line with a bistoury and using a pair of harelip pins with wraparound thread.

NEEDLE REMOVAL

LeClerc’s 1701 advice in handling the through-and-through needles carrying the figure-of-eight thread is of interest:
The Patient must be drest three Days after; and it is requisite at the first
time only to untwist half the Needle, loosening the middle Thread if there
be three; to which purpose a Servant is to thrust the Cheeks somewhat
foreward. On the eighth Day the middle Needle may be taken off, if it
be a young infant. Nevertheless the Needles must not be remov'd till it
appears that Sides are well join'd; neither must they be left too long, because
the Holes would scarce be brought to close.

FROM A FIGURE-OF-EIGHT TO 3 M

Whether the early surgeons used cloth bandages with ties, need­
dles or pins with figure-of-eight wraparound threads or interrupted
sutures, they were not far behind us in this aspect. Today's
sophisticated techniques of three-layered Ethicon suturing, 3 M
taping, adhesive "butterflies" and Logan's bow are mere refine­
ments of the earlier methods. Unfortunately, it is also true that
this knowledge has not permeated to all corners of the world
so that even today untrained surgeons in underdeveloped areas
use antiquated techniques of simple paring and approximation
with results no better than those obtained by Wilson, Paré or
the better "leeches."
VON GRAEFE

The next step in the logical progress of cleft lip surgery involved a more radical paring of the borders to increase the vertical length of the cleft edges. Carl Ferdinand von Graefe, Professor of Surgery at the University of Berlin, about 1816 advocated curved excisions in paring of the cleft edges in lip closure.

HUSSON

In 1836 Husson, a British surgeon, described curved incisions which actually excised much lip tissue, but with approximation of the curved edges there occurred not only a lengthening of the edges to prevent eventual shortening by contracture but also a relative fullness or pout at the free border.

NELATON

Auguste Nélaton, a French surgeon more famous for orthopedic and urological procedures, in 1859 devised a simple lip-lengthening operation which was advocated in incomplete cases when the cleft did not extend into the nostril. A transverse inverted "V" incision was made above the fissure, and the notch was then pulled down, leaving a diamond-shaped wound. Several sutures closed this wound in the vertical direction with specific lengthening at the area of the cleft but not without skin distortion and with far from an ideal scar.
ROSE

William Rose of London, 1847–1910, came from a long line of surgeons and himself became an expert operator with "an exquisite sense of touch in manual skills." He was a drummer, deer hunter (he had antlers everywhere) and the first-rate whip often seen driving his four-in-hand. He was a good teller of tales with "a laughter that could be heard in the next street." Quite early he attracted the attention of Sir William Fergusson, who took Rose with him into private practice and obtained for him an appointment on the staff of King's College Hospital. For a surgeon who knew how instruments should be used, it was a pleasure to watch Rose operating:

He had large and apparently clumsy fingers which were actually extraordinarily dextrous. To see him using the finest of gut in the finest curved needle in a hare-lip operation was to feel that one had met a master surgeon. He came to the Hospital at tea or dinner time to see for himself how the cleft patients fared.

In 1879 Rose advocated a design similar to that of Husson with curved incisions mutually concave from nostril to vermilion and through the vermilion at a 60-degree angle. This provided a line of union of such length that contracture of the scar would not make a notch in the red margin. Rose was responsible for popularizing this approach some 60 years after von Graefe and at least 40 years after Husson first described the principle.
James E. Thompson, 1863-1927, originally from Northwick, England, subsequently became Professor of Surgery at the University of Texas in Galveston. In 1912 he described an angled paring to lengthen the cleft edges and delineated with feeling and a sketch the lovely curves of the normal lip:

The mucous membrane of the upper lip is separated from the skin by a sharply defined line which is carried from one angle of the mouth to the other in a beautiful curve known as the cupid's bow. The convexity of the bow points upward toward the nostrils, but the middle of the bow takes a sharp downward turn. . . . Resting on the middle of the cupid's bow we have a pear-shaped depression which forms the center of the upper lip.

After this poetic discourse, he acknowledged reality:

Even the most sanguine operator never dreams of reproducing a Cupid's bow.

He admitted that

the completed lip is often a wretched imitation of Nature's masterpiece.

He emphasized that

the newly formed lip must not be too short but must be lengthened so that it will more than cover the gums.

He designed his paring procedure generally in the shape of a diamond excision and advocated accurate marks with a compass so that the angled excisions on each side would make it match its opposite. When the vermillion thickness varied, the angle of the mucosal incisions was varied to balance the vermillion closure. Thompson also noted the importance of medial placement of the alar base.

These are Thompson's own 1912 words in defense of the originality of his procedure:

The flaps are pared according to the method of Rose, but the conception and actual performance of the operation differ so radically from his that the operations are totally unlike.
Ironically, progress has narrowed this gap, and history groups their contributions into the Rose-Thompson principle.

A MAYO

Charles H. Mayo, one of the famous Rochester, Minnesota, surgeons, was said to have a "sixth sense"—mechanical versatility. He could master a difficult situation with exceptional speed, and, since he enjoyed variety, his operating list might include excision of a knee joint, sectioning of the gasserian ganglion, a hysterectomy and a cleft lip. He developed a method for lip clefts which was respected enough to be included by Binnie in his 1916 book. It was designed for certain incomplete notched lip clefts in which the ala of the nose was flared and the nostril wide. Mayo advocated relieving the tension thoroughly by separating the ala from its deep attachments. Then, after denudation at the floor of the nostril and by pulling the lip downward and introducing sutures, he converted the horizontal nasal floor wound into a vertical one. This resulted in obliteration of the lip notch along with correction of the deformed position of the ala. The economy of correcting two deformities with one maneuver has appeal.

LADD

The tall and distinguished William E. Ladd, pioneer in pediatric surgery at Boston Children’s Hospital, corrected every deformity occurring in a baby from cleft lip to imperforate anus. In 1915 he developed a cleft lip procedure which increased the vertical length of the cleft edges by straight paring carried further laterally and cutting through the vermilion at a 90-degree angle.
Staige Davis approved this method in 1919, but actually it seems in principle to be a step backward because lengthening by extensive lateral parings tightens the lip from side to side, particularly at the free border, and destroys any eversion or natural pouting.

In 1945 I was one of Dr. Ladd's last group of surgical interns. I remember that he was more concerned with tracheo-esophageal fistulae at that time and seldom operated on a cleft lip. He acknowledged that a plastic surgeon specializing in this problem should produce better results. By this time cleft lip surgery had become a specialty beyond the scope of the general surgeon; fortunately, many of the general surgeons were wise enough to accept this fact.

**B R O W N**

Because of their region of interest, the oral surgeons compose another group of specialists who have been active in cleft lip and palate work and in the early days also made contributions. Even today they often concern themselves with the problem. G. V. I. Brown, D.D.S. and M.D., at Milwaukee's Children's Free Hospital in 1918 described straight turning of mucosal flaps from the cleft edges to form an asymmetrical tubercle similar to the plan of Ladd and with similar discrepancies.

The more popular Rose and Thompson methods paradoxically became known as the *conservative* surgical approach to cleft lip. It now has become apparent that this approach was indeed *more radical* than realized as it inadvertently destroyed natural landmarks. Yet other surgeons made their name embracing the same principle, and a few continue to do so even into the second half of the twentieth century.

**V E A U**

In 1925 Veau published his first cleft lip method which, although primarily a straight-line closure, had aspects similar to those of Mirault's final design. Veau subsequently abandoned this early plan as he gradually changed his technique.
Victor Veau, a general surgeon of Paris, was one of the great cleft surgeons of all time. He was a tall, gentle man with a small goatee and an aura of *bonhomie*. Through his voluminous cases, as seen in his *Bec-de-Lièvre* published in 1938, he not only had extensive experience with many designs but a remarkable influence on cleft surgery throughout a great part of Europe and Britain.

*Sophisticated straight line*

Veau’s final unilateral cleft lip design was a variation of lengthening the edges of the cleft by paring. On the non-cleft side he pared the mucosa just distal to the mucocutaneous junction line far enough to achieve a length equal to the normal. On the cleft side he pared laterally just proximal to the mucocutaneous junction line an equal distance, freeing a mucosal flap for overlapping the free border on the non-cleft element. This aspect of his approach, strangely enough, is reminiscent of a technique originally attributed to Mirault as his second method but is not the method now recognized as Mirault’s procedure. Veau also freed the alar base and turned it across the cleft just inside the entrance to the nostril, a trick used by surgeons before and after him.

Principles of cleft closure for which Veau also was renowned involved his vigorous approximation of the muscle elements with wire *suture musculaire* and his closure of the anterior palate simultaneously with lip surgery. He rarely was able to achieve a symmetrical cupid’s bow and, invariably, ended up with severe asymmetry of the nose, the disadvantage of a straight-line vertical scar and often subsequent retrusion of the maxilla. Yet, in its simplicity and several aspects of surgical soundness, the Veau approach still enjoys popularity today in various areas throughout the world—and certainly wherever the French have had influence and their lovely language is understood, even unto Indochina.

**LIMBERG**

In his gray and silver 1963 handbook, translated by resident Tony Wolf, Alexander A. Limberg of Leningrad, a gentle and refined
senior surgeon of Russia, incorporated the modern touches of primary nasal correction and preservation of the cupid’s bow into the old Veau straight-line design.

Important in his complete cleft closure is the release in the upper buccal sulcus which he refers to as a right-angled “poker incision.” The soft tissue of the lateral lip element is freed from the bone and advanced without tension. As he explained:

Angle K closes from 90° to 0, while angle M opens from 0 to 180° and due to the elasticity of the mucous membrane the advancement occurs without conical distortion.

On the non-cleft side, his “poker incision” starts at the high point of the vermilion border, continues along the edge to the nasal vestibule and at the lateral surface of the nasal septum cuts at a right angle and opens 45 degrees. A triangular flap with a superior base taken from the cleft edge of the lateral lip element is transposed across the cleft into this medial dart. A vermilion flap from the cleft side is also inserted into a releasing incision in the vermilion on the non-cleft side in another maneuver similar to that of Veau but credited by Limberg “after Miro, 1844.”
The modern British champion of the conservatives was Nuffield Professor Thomas Pomfret Kilner of Oxford, trained in plastic surgery by Gillies. He was short, rotund and genial enough to remind one of a Toby jug, but his appearance was deceptive for he could be quite irascible. Son of a Manchester schoolmaster, he always retained some of the teacher characteristics, being a strict disciplinarian with an organized, tidy mind insisting that everything be preset and absolutely correct. As noted by Dick Battle, a student of and assistant to Kilner for years, his inflexibility was reflected in one of his favorite dictums:

God protect me from the surgeon who changes his plan in the middle of an operation.

His cleft lip method was a careful straight-line approximation of the separated parts with the removal of the minimum of tissue, paying particular attention to muscle union. Actually, the method used by Kilner was a refined combination of Rose, Thompson and Veau, paring to lengthen and then to approximate. What he wrote in 1937 he stuck to the rest of his life.

In my opinion, it is wiser to underdo things at the early operation than to sacrifice too much tissue in a desire to produce a perfect cosmetic result. The essential principle in primary lip cleft repair is suture in layers and adequate apposition of the muscle layer is the keynote of success. When the lip has functioned and developed for a few years it is easy to add any finishing touches which are required. The ease with which this is done varies according to the simplicity of design of the initial repair. All types of flap operation render it more difficult.

His design of a unilateral pre-alveolar cleft with paring and mattress suturing had the appeal of simplicity.
Kilner was a pure irreversible conservative. When baited about the merits of a flap method he would glare sternly over the top of his little half-spectacles and insist:

I am unalterably opposed to chopping up the lip with flaps!

Of this straight-line closure David Davies of Cape Town said in 1971:

I was privileged to assist the late Pomfret Kilner with a lip repair on his visit to South Africa in 1958. Meticulous and loving workmanship produced a near perfect lip from a straight line repair. One cannot ignore such a display of virtuosity but as a corollary one cannot accept such techniques as the norm. Straight line repairs have the advantages of simplicity, ease and speed but the long term results are not satisfactory. Kilner pointed out that the operation is so sparing of tissue it lends itself to secondary correction. However, no secondary correction is really as easy as the primary repair and one should aim for a normal shape and form at the initial operation.

F A R A

Miroslav Fara of Charles University, Prague, obsessed with the worthy desire to get the orbicularis oris muscle fibers joined end to end across the cleft, explained to me in 1972,

In the case of unilateral clefts I prefer now to operate by methods using straight or almost straight incisions and sutures because I am able more easily

1) to fold down the muscles for suture end to end,
2) to shape the ala nasi by means of an auxiliary skin flap, going from the lateral to the medial side in the threshold of the nostril, and
3) to perform the final corrections on the lip.

This is the Kilner philosophy but with more sophistication in the positioning of the muscles and a Trauner adjunct for the nose.

P E E T

The genial Eric Peet had served as a plastic surgeon in India during World War II and, at the same time, become a tiger
hunter. Fortunately, he lived to tell such tales as that of the day he was thrown from an elephant into tall grass with a wounded tiger. In the fall he lost his rifle, but the faithful elephant boy drove the elephant back into the tall grass to bait the tiger's second attack. This gave Peet the seconds he needed to retrieve his gun, retreat and wait for a pickup by the elephant before the final return to finish off the tiger. After incidents like this it is easy to understand why Peet was content to become one of the archconservatives of Oxford.

By now, however, the importance of preserving the cupid's bow had become established, so his markings and excisions took these landmarks into account. As he wrote for Rob and Smith in a book which was published after his death:

The medial incision is a curved one, equal in length to the normal side of the philtrum. The angle between the lower end of this skin incision and the skin vermilion line is designed to be the same as that between the philtral ridge and skin vermilion line of the uncleft side, in an attempt to produce a symmetrical Cupid's bow. The skin incision on the lateral side of the cleft will usually be almost a straight one, equal in length to the normal side of the philtrum.

A secondary Z-plasty

Yet Peet's sporting streak got the best of him eventually for he partially broke from the purist stand and prescribed a Z-plasty in the middle of a straight-line closure in cases in which the vertical height of the lip was unduly short on the cleft side. He mentioned that his Z-plasty produced a natural eversion of the lip.

For Peet, this divergence from the straight line was venturing into tiger country with Kilner, who considered such action only that of a “renegade.”
At first thought, one may be lulled into Peet's logic. As a conservative turned flapper, he had a point:

Z-plasties are the accepted approach to straight line contractures.

Yet when used in this fashion in cleft lip, two plastic surgery principles are violated. First, the use of generous curved excisions for paring the cleft edges causes much valuable tissue to be discarded, tissue that could well be used in the Z-plasty. Second, this is a Z-plasty that violates the natural lines as well as the philtrum of the lip.

Masters

A variation of the straight-line closure was described in 1954 by Frank Masters with Georgiade, Horton and Pickrell at Duke University. They advocated simple interlocking "Z's" with 90-degree angles in the repair of incomplete clefts. This approach did not lengthen the cleft edges except by paring but did interrupt the straight-line closure. It might just get by in very minor clefts but, as Masters says today, it is seldom used except in certain secondary cases with a thickened straight-line scar.

Bartels

Roger Bartels with O'Malley, Douglas and Wilson in Orlando, Florida, in 1970 modified the interlocking for a wider variety of cases by varying the angles in the lateral incision. As Bartels explained in 1972, he rarely sees primary clefts, but this method has been useful occasionally in secondary cases as a slight amount of edge lengthening can be achieved in addition to a breaking of the straight line of closure. Yet it would be the latest Disney World fantasy to claim that this more primitive principle would satisfy modern standards in most clefts.

Both this and the Masters design call for much tissue discard, an unnatural scar line and no provision for positioning or salvaging natural landmarks.
In summary, it can be said of the so-called conservative approach that paring to lengthen vertical height produces a fairly good-looking lip, depending on the craftsmanship of the surgeon, and reasonable function inasmuch as the muscles have been united. Yet, since both tissue and important landmarks have been discarded, the results are lacking both in substance and in natural detail, and these, alas, are then lost forever.
8. Full-Thickness Flaps for Vertical Lengthening

A means of shifting tissues from an area of plenty to an area of paucity is achieved by the concept of cutting full-thickness flaps of skin, muscle and mucosa of the lip. This more advanced principle was used almost as early as the angled paring of cleft edges to lengthen the vertical height. Paris was the center of this new fashion in lip surgery which came into vogue almost half a century before the Eiffel Tower.

MALGAIGNE

Joseph François Malgaigne at the University of Paris, frustrated by the contracture of the popular paring and straight-line closure of his day, wrote in 1843:

I came to the conclusion that with all the surgical skill available, we could only transform the severe case of cleft lip to its mildest form. It is virtually impossible to remove the notch of the vermilion.

Obsessed with the determination to obliterate the inevitable postoperative whistling deformity, Malgaigne designed a two-flap operation. He pared the upper half of the cleft edges. Then he made horizontal full-thickness relaxing incisions which, when opened like two "V's" and closed one to the other in a straight line, exaggerated the lengthening of the edges. In fact, the
despised notch was transformed into an almost equally obnoxious asymmetrical tubercle.

MIRAULT

Following Malgaigne's report of the operation, G. Mirault, also of Paris, immediately saw its value and a flaw. Two months later he wrote Malgaigne suggesting the use of only one horizontal incision and the mere paring of the other edge to avoid the tubercle. This procedure, in essence, produced a triangular flap to overlap the opposite side. There seems to be much controversy as to which side produced his flap. In his thesis for Doctorat en Médecine in 1930, Paul Plessier of Paris outlined the two methods of Mirault. The first used a flap from the cleft side; the second took a smaller flap from the non-cleft side.

By 1846 Mirault's triangular flap method had gained enough importance to be reproduced in a surgical textbook by Claude Bernard, and the illustration indicates that the triangular flap was taken from the cleft side to bolster the medial element.
It is interesting to study the various renditions of the Mirault method as described by Thompson in 1912 and Binnie in 1916.

This method proved to be the stimulus for many modifications over a span of 100 years.

**AN IRISH MODIFICATION**

The best of the early modifiers was M. H. Collis of Dublin, who improved Mirault's procedure by preserving tissue for the nostril floor, establishing a principle to be utilized later by many other surgeons. In 1868, in the spirit of a true plastic surgeon, he wrote of his "aesthetic method."

I never throw away a particle of the parings. My incisions are made so as to make every fragment of them useful.

Here are two photographs kindly supplied by the Royal College of Surgeons, Dublin. They represent different cases, but both have Collis' note inscribed beneath them. One shows a more severe cleft and the other the result of Collis' procedure on probably a less severe cleft with minor discrepancies still present in the lip and nose.
OWEN’S FOLLY

During this period of pioneering there were many who in attempting to modify Mirault’s method actually mutilated it. For example, an Englishman, Edmund Blockett Owen, 1847–1915, was a vigorous surgeon at Great Ormond Street Children’s Hospital, a fly fisherman and captain of the St. Mary’s Hospital football team.

It is possible he poured too much athletic enthusiasm into his cleft lip operation when, in 1890, he modified Mirault. By reversing and exaggerating the triangular flap until it extended across the entire border of the lip, he actually displaced the mouth into a lopsided position.

A report by one who knew him well might explain this procedure:

The transparent honesty of Edmund Owen shown not least in an impulsiveness which led him to hasty conclusions, soon to be put aside so that he would vote tomorrow against that which he had advocated today.

It is hoped that such was the fate of his lip procedure before too many unsuspecting young surgeons had been tempted to try this atrocity.
9. Perfecting the Triangular Flap

Two great St. Louis surgeons directed their thoughts toward perfecting Mirault’s principle and carrying it to its ultimate. They were Vilray Papin Blair, an anatomist and innovator, and James Barrett Brown, an exceptional craftsman. Both were well-trained general surgeons, and together they constructed a midwestern plastic surgery center at Washington University. From their headquarters by the muddy Mississippi they dominated the cleft lip surgical scene from 1930 to 1948, and during this time cleft surgery made great strides.

BLAIR

Vilray Blair was a descendant of one of the early French settlers who had come up the Mississippi River from New Orleans to St. Louis when this boomtown was the eastern gateway for adventurers, explorers, trappers, traders, missionaries, gamblers, soldiers and settlers. One of his forefathers was Vilray Papin, a trapper who often left his family for long intervals while out catching animals for skins. There was one time when he was gone for over a year. Upon his return he found that his wife, thinking him dead, had remarried and started a new family. Blair, a devout Catholic, delighted in the fact that he had descended from the legitimate side. He attended Christian Brothers College and had to ride horseback out and in from Grand Avenue, which, as he put it,

was one of the main reasons I was sent out there to school ... and to shoot a few birds on the way home.
From extracts of reports by J. P. Webster, Barney Brooks, R. H. Ivy and Gordon Letterman, the preparatory exploits that led to the making of this plastic surgeon can be unfolded. After one year in St. Louis Medical College, Blair took a year off to help string high-tension telephone wires across the Rocky Mountains. He returned to school and proved his ingenuity by graduating with his original class, having managed to receive credit for stringing wires. After six years of postgraduate training, he "broke flat," as he termed it, and took to the sea, ending up in Edinburgh where he tried to get into the Boer War as surgeon on a British ship. Barney Brooks, who had been at Washington University with Blair and Brown years before, was my surgical chief at Vanderbilt University in 1947 when he wrote of Blair’s Edinburgh experience.

His application was refused because he did not have with him his medical credentials. He was out of money and pawned his watch chain, a family heirloom, for a pound. . . . Then he received a telegram offering him the position of surgeon to a ship sailing to Para. He wired acceptance and went to the Public Library to find in what part of the world Para might be.

Blair sailed a thousand miles up the Amazon and its Negro River branch and then signed on for a voyage to the white man’s graveyard, the Gold and Ivory Coast of West Africa, where he joined a troop transport ship during the Ashanti War. His description of events was vivid.

I had not been at sea a month before my curiosity was permanently piqued by the partly fabled, partly true tales of the wealth, the dismal forests, the great rivers, the savagery, the mahogany, the gold and the curios of the surf-bound, fever-stricken west coast of Africa, which has furnished gold, ivory, and slaves to the civilized world from time immemorial. . . . I had not only the curiosity of an ordinary traveler, but my opportunities of observation of fevers of the Javery, yellow-jack, and beri-beri in the Brazils and leprosy in the islands, had taught me there were advantages in studying endemic diseases in their native habitat.

Blair was 30 years old when he returned to St. Louis, finally content to embark on a surgical career.

In time, Blair got to be known as the "lemon" surgeon of
St. Louis because everyone sent him problems and complications. He was a modest, unassuming type of genius who would wake up in the night and scribble down possible answers to problems. Then in the morning he would call in a friend to help him decipher his scribblings and decide whether the idea was any good or not.

Appalled by the many absurd operations being used at this time on cleft lips, Blair wrote:

As a rule the simpler plans are easier to execute but they are less plastic. Every added complexity of technique is a distraction. Before adopting the more complex methods, therefore, the operator should make himself familiar with every detail of the operation and should understand the logic for doing it. As the operator acquires more skill he may feel justified in adopting a method that in earlier days he considered less feasible, but each modification will be like changing a golf stroke—not always free from immediate grief.

In 1930 Blair and Brown wrote:

We have had experience with three different operations consecutively. The Mirault type was taken up ten years ago and has been used ever since. The Rose operation was finally abandoned on account of the difficulty in controlling the tendency of the reconstructed lip to be inartistically long. The Owen operation, which is a decadent form of Mirault, was also abandoned because the results were still more objectionable. It is upon the “Mirault operation” that the following procedure was based, but the details as given in this paper were gradually worked out from our own experience. The logic of the Mirault plan is that a flap is taken from the upper part of the lip where there is excess tissue and implanted into the lower border where tissue is most needed.

It was their belief that the lip defect is triangular in shape and positioned apparently in the lower part of the lip. This is the premise on which all Mirault-type operations are based.

The Blair-Brown outline of operative technique can serve today:

The first step is to mark off on the lip the plan of the external skin incisions. This will outline the raw surfaces to be united by sutures. Upon the accuracy of these cuts will depend the possibilities of the ultimate result. Therefore, while they are first planned and measured off with the eye, they
are checked up with fine pointed dividers and pricked in with aqueous methylene blue solution on a fine "crow quill" pen or a hypodermic needle, before any cuts are made, so that the landmarks are not obscured by the undermining and the accompanying flow of blood. The first operative step is the mobilization by undermining of each distorted or displaced tissue. This should release the restraining tissues from their underlying bony attachments, and at this stage cartilage may have to be shifted in its relation to bone, its fellows or the overlying skin. The most important point in the operation on the lip is not to excise too much tissue from the lip or any at all from the lining of the nose. Bad suture scars are almost as great an evil.

**The Blair-Mirault design**

The specific markings were set by pricking point A on the mucocutaneous junction where the oblique base of the columella intersects vermilion. B was placed just above where the ridge that bounds the philtrum on the opposite side meets the mucocutaneous junction. C is halfway between A and B. Okay so far . . .

On the cleft side A' is pricked just below the point of the ala. The placement of point C' has a *mercurial elusiveness* which almost discouraged me in 1944 from trying to become a plastic surgeon at all. In Blair's own words:

The placing of point C' requires some consideration. It should be under and rather internal than external to A', and at a vertical distance from the vermilion border equal to CX. X is supposed to represent the future level of the vermilion border at this point.

B' is on the mucocutaneous line at a distance from C' equal to BC.

In the creation of a triangular flap C'B'X' from the cleft side, a relatively large amount of tissue was left attached above to the alar base as flap A'C'B'. Like Collis, Blair used as much as seemed indicated to aid in reconstructing the nasal floor. Unfortunately, much of this valuable tissue had no place to go and was simply amputated. Before the marks were incised, hemostatic clamps were applied; then A was sutured to A', B to B' and C to C'.

The vermilion Z flaps were interdigitated.
The hazards of placing C'

Misplacement of point C’, with, for instance, C’X’ being longer than CX, can be and often has been responsible for strange derangements, and the purse-string correction is not as easy as it seems.

As a pioneer of the flap approach to cleft lip, Blair was bombarded with arguments offered by the conservatives and he proceeded to collect scientific data to prove them wrong. He wrote:

The statement has been lately emphasized that using a displaced flap in the repair of a lip cleft would cause muscular distortions in the movements in the new lip; with this point in view, we have recently made a study, both directly or by means of movie films, of about thirty cases operated on by this plan, and, in none of them, after the immediate postoperative stiffness disappeared, were there any asymmetrical contortions evident.

Blair and Brown were among the first to define and try to correct the transverse axis of the cleft nostril and the flattening of the nasal tip on that side:

To correct these nostril distortions it is necessary first to mobilize all mal-related structures with the least amount of external scars; second, to draw them into the most natural form and position attainable; third, to fix them by suture until healing has occurred.

Blair also alluded to the importance of talent in the operator:

After the surgeon has gained the greatest possible surgical and mechanical skill with the most congenial method, he may still find that the results are not really pleasing unless his technique included also artistry, which here, as in portraiture, can camouflage a multitude of defects.
Although Blair’s sense of artistry made him painfully conscious of one of the shortcomings of his method, he accepted it with rationalization:

It seems impossible, by an acceptable means, to restore the philtrum, but the lack of one bordering ridge is not very noticeable if the restoration is otherwise pleasing.

Blair was crazy about horsehair for suturing skin, considering store sutures brittle and worthless. He kept an old white horse at the little Mullanphy Catholic Hospital, and whenever his supply got low he would go out and pull a few specially chosen hairs from the horse’s tail and have them boiled. Then he would sit and hum while happily tying knot on knot in the horsehair sutures of his cleft lips.

W. L. Shearer was visiting one time and watched Blair at work until he could stand it no longer.

"Why is it, Dr. Blair, that you tie 6 knots in the horsehair each time?"

Whereupon Blair answered:

"Because 5 won’t hold!"

**Teacher**

Blair was a great teacher, and among his early students were such famous names, along with James Barrett Brown, as William Hamm of Atlanta, Earl Padgett of Kansas City, Louis Byars and Frank McDowell of Saint Louis. Most of the men who became leaders in America at one time or another observed Blair at work. In fact, surgeons came from far and near. As Hector Marino of Buenos Aires, Argentina, recalls:

I remember seeing Old Papin Blair undo a lip two, three times because the result was not up to his artistic expectations. And, how he took his time to explain to his young assistant the unapparent little secrets of the trade that made all the difference in the end result.

Evidently it depended on his mood, for Gerald O’Connor of San Francisco recalls once asking Blair:

"Vilray, I have read your article 50 times but I noticed you did not explain how you make that beautiful alar sweep at the base of the cleft nostril. Could you explain how you do it and where the lining comes from?"
O’Connor said Blair rubbed his chin, looked him square in the eye and said:

“I don’t know, Gerald, it just comes from experience.”

Selling plastic wares in the marketplace

Realizing the importance of general doctors’ knowing modern developments in plastic surgery, Blair set up a cleft lip exhibit on the famous Steel Pier in Atlantic City at the American Medical Association meeting in the mid 30’s. He arranged an automatic slide projector to present each step of his operation. When his friend Robert Ivy sauntered by his demonstration, Blair called him over and they stood and watched the series of slides.

“You know, Bob, they accuse me of not showing every step of the operation. Now look, there is the original deformity, there the important marks are made, there are the incisions, there are the flaps being fitted into position, there is the final result with the sutures. What more do they want?”

“That’s right, Vilray,” said Ivy.

“Trouble is,” admitted Blair with a twinkle, “the machine changes the slides too fast!”

A BOSTONIAN SOOTHSAYER

Varaztad H. Kazanjian of the Massachusetts General Hospital and Eye and Ear Infirmary was an astute Armenian who had served in World War I as a dentist in the Harvard Base Hospital Unit with the British Expeditionary Force in France and upon whom King George V conferred the Order of Companion of St. Michael and St. George. This pioneer of face and jaw wounds eventually became Professor of Plastic Surgery at Harvard University. His vast experience and sagacious observation in the trauma and healing of lips and maxillae prompted him in 1939 to lay down some wise criteria for making a choice of the primary lip procedure, whether it be, as he said, “Mirault, Blair, Rose, Husson, Thompson, Veau or Ladd,” for these were the popular methods of this time,
but the method that answers the following qualifications should be given preference:

1) It should involve a minimum of operative trauma.
2) The operative method should be designed toward bringing the separated parts into their normal anatomic position . . . so that when the child grows the lip will develop along normal outlines.
3) For the sake of the immediate result the procedure must not unnecessarily sacrifice skin tissue, because the excision of a piece of skin as small as one-quarter of an inch in length is equal to one-half an inch in length in adult life. A tense lip, besides lacking normal contours, causes undue pressure against the alveolar process of the upper jaw and becomes partially responsible for the retrusion of the upper jaw.
4) It must include correct approximation of the nostrils as an important element of the surgical problem.

A RETENTION SUTURE

To Blair’s modification of the Mirault cleft lip procedure Cyril Callister of the University of Utah in 1948 added a special retention suture set to prevent the lateral creeping of the alar cartilage. After completion of the primary lip operation he inserted a soft rubber catheter to fit the constructed nostril on the cleft side. Then he passed a strong silkworm gut suture from the septum of the normal side through the catheter, on through the alar cartilage near its tip and laterally down and out through the skin at the base of the flaring ala on the cleft side. A split shot was crushed on the suture external to the alar base. This tube and shotted suture were left seven to eight days to protect the lip closure and to allow the dissected tissues to stick down in their corrected position. Of course, the effectiveness of this retention stitch as with most retention sutures lasts as long as the suture retains. After the removal of the stitch, if the operation was not designed to prevent alar cartilage creeping, the chances are there will be a surreptitious creeping back again.

McDowell’s comments on this stitch are pertinent:

The retention suture attributed to Callister was used by Blair in the 1930’s and 1940’s as shown in a diagram from his 1930 S.G.O. paper. Blair usually used small lead plates on each end but sometimes split shots . . . and sometimes both. I had to squeeze the damned split shot on a number of them. Brown hated them. The results were zero.
Brown

James Barrett Brown, working with Blair since 1929, by 1945 had become dissatisfied with the original Mirault-Blair procedure that Blair and he described in 1930. With McDowell he explained:

The main principle of the operation remains just as desirable as ever but better results may be obtained by using a small flap to produce the fullness in only the lower one-third or one-fourth of the lip. . . . A repair with a large Mirault flap (one-half the length of the lip) may be better than a straight line repair, but is not so good as when a small flap is used. It is apt to present the following disadvantages: (1) the large flaps by their greater contraction are apt to lump up more and give a "trapdoor flap" effect; (2) it is necessary to sacrifice a greater amount of lip on both the cleft and columellar sides to fashion and fit in a large flap; (3) the break in the profile line where the forward thrust begins is in the midlip rather than down just about the vermilion border where it normally occurs.

Brown and McDowell continued:

This simplified plan of marking has facilitated the entire operation, has made the teaching of it easier, and has caused some interest to be developed by house surgeons who often appeared bored before.

McDowell

Frank McDowell, one of the renowned St. Louis "four horsemen" and co-designer of the perfected triangular flap, reviewed the early days in 1972.

The great trouble with the Blair-Brown design was that all of the principal marks (A, B, C . . . and A', B', C' . . .) were tied in a way to each other but none were precisely related to the anatomy of the child in front of the surgeon and thus no clear indication was offered just where to put the marks. As a result many people have said they were doing the "Blair-
Brown operation," or the "Mirault operation" and they were actually doing something quite differently without realizing it.

Barrett and I worked years to develop an easily reproducible design with each mark precisely related to an anatomical landmark on the child. Secondly, after experimenting with hundreds of these (at one time we were doing lip closures for the Crippled Children's Divisions of 11 states) we found that a small triangular flap one-fourth of the length of the lip was far better than the half-lip flap that was used only for the first few years. The key to the precise design was the mark in the floor of the normal nostril (that X, not the old X down at the bottom of the vermilion). Once X is put in the same relationship to the columella as A is . . . then one has only to put A' in the same relationship to the cleft alar base as X is to the normal alar base. When this is done, and A is brought to A', it follows that the nostril floors on the two sides must be equal and the cleft nostril base will have to be in the same relation to the columella that the normal nostril base is. (The other marks are similarly assigned to fixed and easily determined positions.)

With these changes, we had almost a new operation and all of us for the last decades regarded this as the definitive version of the triangular flap operation (rather than the early abandoned one).

Curiously, Blair was never able to do what Brown, Byars or I would consider a really good lip repair—in spite of his interest and pride in it. Nor did he ever do very many. He was a genius in developing new concepts of his own and in quickly recognizing the worth of new concepts developed by others. Even 10 years before you knew him he wore gloves even longer than his large hands so that the fingers hung over the ends by half an inch, a floppy condition not conducive to delicate detail. But then he was never particularly good as a technician in doing little fine jobs.

McDowell is a rare combination of surgeon, encyclopedia, indexer, connoisseur and scribe. His writings were always formulated, as he said,

between the hours of 10 P.M. and 3 A.M. at a time when one is not competitive but reflective.

He did his nocturnal writing at 22 Kingsbury Place, St. Louis, in the second-floor study overlooking the central parkway which in winter was covered with snow and tinged yellow by the gas lights. During this time there was a little gray mouse who used to keep him company during these lonely hours. McDowell admits often crumbling crackers for the friendly rodent to show
his appreciation. When Mary McDowell found out about the mouse and was about to set a trap, Frank talked her out of it with

"But who else can keep me company at this hour?"

Here are a few of Frank’s most recent reflections.

I hope, Ralph, that you will state somewhere in your Book that the real test of any lip operation comes at about the age of 20 years in those patients who had wide total clefts repaired in infancy and who have had no operations since. This is not to say that secondary "touch-ups" should not be done, but for valid comparisons nothing will beat these. The usual history has been that each surgeon enthusiastically promotes the repair he is best at doing for about 15 years and when the results start to develop deformities, he jumps over to the newest and most popular repair of that moment—with no assurance whatsoever that the late results of this new procedure will not be even worse.

In comparing results of various operations, it is important to emphasize that the reader should compare the best results obtained by the few surgeons superior at each type of repair (making sure, of course, that they started with clefts of equal severity). There is no limit to the poorness on the downside; the only valid test is "How good are the best when the child is grown?" (and I am sure that none done by any method will be perfect).

As suggested by McDowell, here are examples of the ultimate that he was able to achieve with his perfected triangular flap. An incomplete cleft is shown but with only an early follow-up.

The lip is o.k., good rotation of the nostril, didn’t get dome of nostril up as well as in some.
This lip was mended in 1943 and should receive a high grade for its time in the evolution of cleft lip surgery. In fact, it is better than many of the “would-be sophisticated” methods of today.

A complete cleft operation by McDowell in 1957 did achieve excellent nasal correction, but the horizontal length of the lip from commissure to midpoint is short on the cleft side at six months and at six years still has this discrepancy plus an upside-down bow.

A cardinal criticism of the principle of all modifications of this Mirault-Blair-Brown-McDowell method has been that the final result was without the normal cupid’s bow. Brown acknowledged the lack of a bow with one of his aphorisms,

Only God can make a cupid’s bow,

and then rationalized the discrepancy:

The slight upward prolongation of the vermilion beneath the philtrum on either side, commonly known as a “cupid’s bow,” is present in some normal lips, but almost absent in others. The desire for it, among women, seems to vary with other fashion trends. Various operations have been proposed to create it in the cleft lip, most of them involving incisions opening up almost the entire mucocutaneous border, either at the primary operation or secondarily, and substituting a long scar for this normal soft undulation of tissue. It is thought that the resultant scar of these operations, in some instances, may be more deformity than the absence of the “bow.” Men seem to care little for the “bow,” women are apt to be undecided,
and it seems too ephemeral to be the object of an operation in most instances. It can be artificially suggested by very thin areas of tattooing, or in women by the use of lipstick.

Twenty years later (in 1966) Frank McDowell, editor of Plastic and Reconstructive Surgery, redefended this discrepancy with a skilled pen:

There will probably always be surgeons who feel that the “cupid’s bow” is a desirable goal, and other surgeons who feel that it is something to avoid in ages and sexes other than teenaged females.

It is true that the exaggerated cupid’s bow sported in the gay 20’s by such movie stars as Clara Bow and later cartooned as Betty Boop is no longer in vogue. Yet the soft undulating curves of the normal lip’s bow are desirable in any sex, any age, any time.

ROOTS AND STUMPS IN ST. LOUIS

Once in the study of plastic surgery it was inevitable that I would take at least a portion of my training in St. Louis. My grandfather, C. D. P. Hamilton, the original leather expert for the International Shoe Company, had been enticed from Easton, Pennsylvania, to St. Louis in 1899 when it was still a boomtown. Born at Barnes Hospital, I returned there 30 years later as a house officer during the first half of 1950. It was difficult not to be extremely impressed by the simple direct execution by masterful surgeons of the Brown-McDowell modification. When the baby was wheeled out of the operating room with mattress sutures through the external nasal skin tied over bolsters and the flattened nostril molded round with packing, the immediate result was no less than dramatic. Yet, unlike the other loyal residents, I had learned from Gillies that a lift gained by mattress sutures to hold up a flattened alar dome could be expected to last no longer than the sutures or the packing. I must have verbalized this from time to time.

It was exciting to have trained even for a short time with the great team of Brown, Byars, McDowell and Fryer of 400
Metropolitan Building. Unfortunately, I was not one of Brown’s favorite house officers, but, like so many others, I gained from his didactic teaching—“the optimum time to operate a cleft lip is the first time.” This dynamic native of Mark Twain’s sleepy little hamlet of Hannibal, Missouri, probably had a boyhood that evoked the adventures of Tom Sawyer and Huckleberry Finn. He was a paradox of virtues, with intense likes and dislikes, an intolerance of others’ methods and mistakes and yet not without a touch of Twainian humor. He loved strawberries, Beethoven and St. Louis and idolized a special favorite of many of us, the dexterous faker and humorous plastic problem, W. C. Fields.

Frank McDowell, who knew Brown best and considered him a king, wrote after his death:

The boyish twinkle in his eyes, present until his last working day, effectively punctured pomposity on sight.

This trait was exemplified by a story told by Lieutenant General Hal B. Jennings, Jr., Surgeon General of the U.S. Army, who had trained with Barrett Brown in 1950. Colonel Brown was being commended enthusiastically by Major General John Hurd for his fine work on the war-wounded at Valley Forge during World War II.

"I can say in all reverence that never since the time of Christ have such miracles of healing been seen upon this earth."

Whereupon Colonel Brown, not displeased, replied:

"God still does the healing, General, we surgeons merely rearrange the details."

A FEW WORDS WITH BLAIR

A true highlight of my St. Louis experience was a chance to dine one evening with the renowned, and at this time retired, Vilray Blair. Tall, white-haired and with a quiet gentleness, he listened with sympathetic patience to my questions about plastic surgery. Mindful of his many pioneering feats in head and neck surgery, I asked him:
"Dr. Blair, of all your many contributions to the specialty of plastic surgery which one is your favorite?"

He had a glint in his eye when he answered:

"My cleft lip operation, the modification of the old Mirault procedure which we published in the thirties."

INTERNATIONAL PROGRESS

Of course, the advance brought about by the high standards in St. Louis was caught up in other centers. There was a time in the 40's when the Blair-Brown-McDowell lip operation was used almost universally. Such great centers as Truman Blocker's University of Texas unit at Galveston and A. B. Wallace's unit in Edinburgh used the method exclusively.

Along with its worldwide acceptance new advances began to evolve. Take, for instance, the matador's cape trick perfected in a Spanish surgical arena. Lorenzo Mir y Mir of the Medical School of Barcelona indicated in 1955 in Stockholm that he was convinced that the secondary retraction of the alar base was the result of contraction of the raw area created during the releasing incision which extended from the gingival groove upward through the lateral nasal lining in front of the inferior turbinate. He proposed the use of a mucosal flap salvaged from tissue usually discarded in the Mirault-Blair method which, when whirled like a red cape up into the nose, covered the lateral defect and interrupted potential contracture. This was an important first!
IMPERSONAL EVALUATION

In the fall of 1962, all plastic surgeons of the United States and Canada were sent a questionnaire on facial clefts, and from the 54 percent response Michael Lewin reported that the Mirault-Blair-Brown-McDowell procedure had lost popularity in the last decade, with only 13.9 percent of the surgeons acknowledging present use of it.

Probable reasons for the decline were outlined by Musgrave for Converse in 1964:

There is too much central vermilion discarded, no cupid's bow is salvaged and as the child grows older the upper lip frequently appears tight and the vermilion border thin.

MORE PERSONAL

Since those earlier days as a resident in St. Louis I have had an opportunity to see truly long-term follow-up results of cases operated on by the Brown-McDowell simplified method, some by inept surgeons but others even by an author of the method. My observations were corroborated in 1966 by McDowell's "twenty-year" follow-ups. Although some results are pleasing, it seems fair to say that, in general, the nose often still has a slight slump with asymmetrical flattening of the tip. The lip is scarred in an unnatural position without a philtrum or a dimple. Instead of the natural cupid's bow with its twin peaks, there is often an asymmetrical single peak. A varying degree of tubercle at the vermilion interdigitation is just off-center to the cleft side. The most serious deformity, which seems to occur often in complete clefts, is a relative side-to-side tightness of the lip's free border that exaggerates a protuberant lower lip. The problem is understandable as all the flap action occurs in the lower one-third of the lip. On the medial side the paring of mucosa is carried so far along the edge that when the lateral triangular flap advances to fit this freshening some tension is created. It actually causes gathering of the malleable free border tighter than is desirable, requiring radical secondary correction later. How this is best done is discussed in the Secondary section.
10. Constructing a Cupid’s Bow

ARTISTS ASSIST

THROUGH the years, medical artists when portraying the surgeon’s final cleft lip result invariably constructed a symmetrical cupid’s bow with their pen or brush. This possibly increased their popularity with the surgeons, but any similarity to the true postoperative result was quite unreal. Here are a few reproductions of artists’ concepts of the final result of methods that unequivocally destroyed the bow, yet shown with the cupid’s bow still standing in all its glory.

FINALLY THE SURGEON DOES IT

Thus it was an important breakthrough in cleft lip surgery when the surgeon actually created a cupid’s bow. The number one
champion of this development was the Canadian A. B. LeMesurier, primarily an orthopedic surgeon working at the Toronto Hospital for Sick Children. As LeMesurier himself acknowledged, his operation, except in detail, was not original. In fact, in 1884, 40 years after Mirault modified Malgaigne, the German Hagedorn designed a quadrilateral flap cleft lip procedure which was so far ahead of his time that it took 50 years and LeMesurier to gain it acceptance.

There were quadrilateral flap designs before and after Hagedorn. Actually, Gustav Simon, a Heidelberg surgeon, in 1864 was the first to introduce a quadrilateral flap operation. His main flap came from the medial side and had some advantages but did not create a cupid’s bow and never reached any degree of popularity except as an occasional reproduction in surgical textbooks.

KÖNIG

Another early quadrilateral flap maker was Franz König. He trained with Langenbeck and then became Professor of Surgery at Rostock until 1875, when he was summoned to Berlin as Bardeleben’s successor. In 1881, three years before Hagedorn, König, to obviate the asymmetrical free border of Malgaigne and to achieve midline apposition, devised a frightening bilateral quadrilateral flap procedure for unilateral clefts. It might be construed as a “black sheep” of the quadrilateral flap family.

When well executed it could promise only poor results, but when miscarried, as shown in this photograph from Plessier’s report, its effect was indeed shocking.

Both Binnie, 1911, and Thompson, 1912, referring to von
Esmarch and Kowalzig, gave König credit for two cleft lip procedures. The first has been described and was grotesque.

The second was so unlike the first as to be suspect and strangely similar to that of Hagedorn.

HAGEDORN

The premier of the quadrilateral lip flap surgeons was Werner Hagedorn. From 1831 to 1894 he lived and worked as a general surgeon in Magdeburg, Germany, and at the age of 53 conceived a design for cleft lip which was less mutilating and actually quite ingenious. In principle it differed from the Mirault concept in that the flap from the cleft side was quadrilateral in shape. This lateral flap was transposed, not along the freshened edge of the medial element as in Mirault, but into the opened oblique full-thickness incision in the free border of the non-cleft element.

By 1892 Hagedorn had modified his own method but along the same principle.

As a result of the clever cutting and fitting of these flaps, a cupid's bow was actually created.
The value of the Hagedorn design was unrecognized until LeMesurier presented his rendition of the quadrilateral flap at a dry clinic during an American Association of Plastic Surgeons meeting in Toronto in 1945. The excellence of the lip conformity in this series stimulated such interest that a pencil sketch made from a diagram by LeMesurier was photographed and sent to those requesting it. Several surgeons became ardently enthusiastic after using the method; LeMesurier was invited to present a detailed description of his operation at the 17th Annual Meeting of the American Society of Plastic and Reconstructive Surgery at White Sulphur Springs, West Virginia, November 1948.

The West Virginian shoot-out

To an audience of plastic surgeons always eager for a better cleft lip method, LeMesurier presented his procedure. Prominent in the crowd were the old champions of the Mirault principle. Blair was ailing, but Barrett Brown was there, as was Frank McDowell. Both were ready for the confrontation. LeMesurier fired both barrels:

The flap is cut from the lateral side of the cleft [A] and we have found it simpler and, in some ways, better to cut this flap in a more or less quadrilateral shape and after swinging it down and over, to make it fit on the medial side into a notch formed by the spreading apart of the two edges of a cut [B and C]. If the flap is made to extend far enough up the side of the cleft it will reach the mid-line and the suture line will be in the centre of the lip, which is an advantage. The opening up of the cut on the medial side turns down the muco-cutaneous line here, and the swinging down of the quadrilateral flap does the same on the lateral side. A cupid’s bow is thus formed which can be made of almost any height and, what is more important, can, with care, be made symmetrical on the two sides, with the two parts of the muco-cutaneous line meeting accurately.

All was quiet in the lecture hall as LeMesurier proceeded to show slides of his results for it was obvious to almost all in
attendance that these were the best results yet achieved. As he himself acknowledged, the nasal results left much to be desired, but indeed for the first time the postoperative result of a unilateral cleft lip now sported a symmetrical cupid’s bow.

The audience then turned in anticipation toward the opposition, which for years had reigned supreme without challenge. The air was charged with the tenseness of the rivalry as first Brown and then McDowell stood up and fired shots back in defense of their position with the simplified Mirault principle. The first shots fired by LeMesurier with a series of cupid’s bows had already hit their mark and set in motion a lip trend that was destined to gain momentum.

In fact, Wallace Steffensen came forward at this very moment. Three years previously he had been present during LeMesurier’s demonstration of cases in Toronto. Since then, guided by one of the photographs of LeMesurier’s rough sketch and with a wood-carver’s dexterity, he had developed two modifications, which he now proposed. The first was a triangular wedge excision instead of a mere incision in the medial lip element to facilitate the fitting. The second was an attempt to improve the nasal distortion. He advised the Smith dissection of the skin from the alar cartilage through a paramarginal incision and the sectioning of the chondromucosal lining from the septum and through the junction of the medial and lateral crus of the alar cartilage to allow better nostril adjustment.

LeMesurier and the quadrilateral flap had won the day. His success was not temporary because in the ensuing years many more began to use his method and others modified it.
Personal experience with the LeMesurier method

As the first half of 1950 came to an end, I left St. Louis with two students of plastic surgery from South America, Robert Milan of São Paulo and Guillermo Rojas of Bogotá. We three drove north, crossed into Canada and made our way to Toronto. Here we had the good fortune to meet LeMesurier, a distinguished-looking and most pleasant gentleman, who allowed us to watch him do one of his lip procedures. It was thrilling to see the author perform. Yet for us, who were trained in the meticulous detail of wound closure, he seemed more like a general surgeon, using larger sutures widely spaced.

During the second half of 1950, in Detroit on a fellowship with Claire Straith, I learned the practical details of the quadrilateral flap. With his plastic surgical technique it might be said that Straith out-LeMesuriered LeMesurier.

A chance to try

In 1951 as senior resident at Jefferson Davis Hospital in Houston, Texas, under Drs. Cronin, Hardy, Wise, Brauer and Freeman, I finally had the opportunity to treat two primary cleft lips with the LeMesurier technique. One of the patients, a pleasant teen-aged black girl, caught the eye of Dr. Truman Blocker, who had come up from Galveston to inspect our residency program for board approval. He turned to his friend Cronin:

"Tom, do you get results like that? I'm not sure I do with the triangular flap."
The discussion that followed favored the quadrilateral flap, and Blocker indicated that he would influence his residents to use the LeMesurier method but admitted, "For myself I plan to finish out my twenty-year series with Brown's triangular flap."

The second primary LeMesurier I did was on a remarkable woman of 35 years who happened to come into Jefferson Davis Hospital one day to see an ailing friend. When she laughed, which she did quite often, with good lighting you could see her tonsils. I must have revealed my lust to cut a quadrilateral flap on her just short of actual salivation for she laughed and said, "Better doctors than you have tried, son," and flatly refused surgery. The paucity of complete clefts in the residency at this time caused me to take her arm. She agreed to come with me to talk over the possibilities and when asked how she was getting along she reported: "Fine, been married twice! Had to divorce the first because of his continual drinking." "You have to admit he had a point!" I gambled, and although she laughed it was not so enthusiastically. Somewhere between there and the admitting office she reversed her decision.

The LeMesurier operation improved her appearance and function, and although I was disappointed in the artistry of the result she was elated. As soon as the stitches were out, she gave a party in her little Texas town and sent me an invitation. Although I was unable to get off duty that evening, it was reported later that 300 others came from all the ranches round about exclaiming she was now every bit as fine-looking as her sister.

During 1952-1953, while writing The Principles and Art of Plastic Surgery with Gillies, I had the opportunity to demonstrate the LeMesurier method on an incomplete unilateral cleft to Sir Harold. He observed and listened carefully, and when the operation was finished he commented:

Very nice, dear boy, but I leave all those fancy markings to you. You know, I do not get many primary lip clefts any more. Shall we use this one in our book?

We did.

127
To simplify the basic plan of this quadrilateral flap design I have charted a numerical equation which offers some security toward the production of a symmetrical cupid's bow. The key to the bow making depends on the incisions cutting the distance from 2' to 5' slightly less than from 3' to 4' and the distance 2 to 5 equal to 2' to 5' and 3 to 4 equal to 3' to 4'.

Meanwhile back in Texas, there was Raymond Brauer, who had learned the LeMesurier technique quite early, in 1946, from Fred McCoy, who, in turn, had learned it from Wallace Steffen sen. Brauer introduced the method to Cronin in Houston and modified the design, winning an Honorable Mention prize in the Foundation Essay Contest. He advocated using the vertical length of the normal side to calculate the length of the cleft side of the lip, which he marked with ink points on an applicator stick to take the guesswork out of the marking. During his essay presentation in 1953 in England, Brauer recalled the reaction of pleasure by the British Association of Plastic Surgeons when they stamped their feet in response to an exceptionally fine color close-up of a single cleft operation by his method taken with the baby under heavy sedation.

Also in 1953 in Indianapolis, the compulsive and dexterous Thomas Bauer, with Trusler and Glanz, raced into the LeMesurier design but, as an interesting adjunct in wide maxillary clefts, suggested using mucous membrane flaps turned from the cleft edges to line the upper lip.
Finally, in 1962, the wise and unpretentious A. B. LeMesurier published his pleasant and personal little book, *HARE-LIPS and Their Treatment*, in which he presented, out of 1,444 cleft cases (more than half of which he had operated on himself), 14 long-term unilateral results. He divided the lip clefts into complete and almost complete, the halfway clefts and the minor notches, and he outlined designs for each type.

*For complete clefts*

![Diagram of complete clefts]

*For halfway clefts*

![Diagram of halfway clefts]

*For minor notches*

![Diagram of minor notches]

After 20 years' experience, LeMesurier reminisced:

... practically all the [1,444] operations were done on the same general principles. I was in a position, first as a junior and later as a senior, to see, or at least to hear about, any changes that were tried and any unusual results that were obtained. Many changes were tried, but during the whole twenty years, surprisingly few were adopted and all these were of a minor nature.

Here are two cases operated on by LeMesurier in the 40’s, chosen at random by H. G. Thompson, at Toronto’s Hospital for Sick Children, who noted in the boy:
A very adequate result with a tidy cupid's bow, good lip length and symmetry throughout.

For the girl Thompson pointed out:

The degree of cleft severity is slightly increased but the red/white lip junction has not been married uniformly. This has left the cleft portion of the cupid's bow high and is probably due to the fact that the tip of the flap was the same, or narrower, than the base. This left the young lady with a pleasing result but a notch in the red/white junction.

The method, while producing an artificial cupid's bow, requires the sacrifice of much valuable tissue. This discrepancy was defended by Steffensen:

The amount of tissue which is discarded appears great at first glance, but careful analysis of this tissue reveals that it is not satisfactory for utilization in the repair, nor is it necessary to effect the repair.
In clefts in which tissue is already missing any discard of further tissue is too costly. It is on this discrepancy of tissue discard that I attack the basis of Musgrave’s 1964 proposition that

The LeMesurier procedure must still be considered a good operation for the very wide and very severe cleft lip.

If, he adds,

... the measurements are carefully made to keep the lip “short.”

He offers as a teaser:

It is not always necessary to discard some of the medial portion of the lip nor to insist that the flap must reach the midline of the lip.

Of course, this begins no longer to be the LeMesurier method.

M A Y

For years, Hans May of Philadelphia used the Axhausen technique for cleft lip, and with the revival of the Hagedorn quadrilateral flap method by LeMesurier he combined the two principles in 1955. E. V. McNett’s illustrations outlined his design with the marking of incisions, construction of the nasal floor, rotation of the alar base and finally fitting of the quadrilateral flap in the lip closure. This combination had the advantages of both but destroyed some of the natural cupid’s bow and did so with an unnatural scar line of union.
Hugh G. Thompson of Toronto, trained in cleft lip surgery by LeMesurier, recalls how the grand gentleman often walked into the operating room with a lighted cigarette hanging from his lips and his eyes squinting from the smoke. According to Thompson, in 1972, the basis for Dr. LeMesurier's lip repairs was always founded on excess fullness of the leading edge of the repaired lip. This included white and red but particularly red. He attempted to create the central red lip excess and, indeed, labeled this "Marlene's blob"... and when evaluating a late cleft lip repair he referred to it as either "pretty" or "not pretty"—There were never gradations.

Thompson is making a name for himself, having become known as a "terror" among residents during Canadian Board examinations. In 1971, as he was working in LeMesurier's old milieu at the Hospital for Sick Children, he was delegated by Grabb to describe with clarity the quadrilateral flap method. Previous descriptions had been vague, and Thompson claims that he merely parroted LeMesurier's efforts with nothing original other than the fact that all measurements were exact and you can use compasses and come up stage by stage with the exact in vivo concept.

Actually his diagrams showed a Collis nasal floor flap and a triangular buccal-gingival flap Z taken from the medial side based on the premaxilla. This was transposed across the cleft to fill the triangular raw area resulting from the lateral vestibular releasing incision used to free the alar base and lateral lip from attachments to the pyriform fossa. The alar cartilages were freed from the skin in the Brown-McDowell dissection and temporarily fixed with mattress sutures. Thompson pointed out with candor and examples the typical unsatisfactory results with this method: (1) long cleft segment, (2) flat cupid's bow, (3) notched or double cupid's bow, (4) reversed cupid's bow, (5) wide nasal floor, (6) redundant red lip.

I was fascinated to hear from Thompson in 1972 that:
When I originally started in practice eleven years ago, several of my patients had a quadrilateral flap repair but I then became enchanted with the Tennison-Randall-Thompson modification, and this we have used to a somewhat exclusive nature ever since.

**Critical assessment**

There is little doubt that the quadrilateral flap fitted into an incision on the non-cleft side as popularized by LeMesurier was a great improvement over previous methods and did indeed create a symmetrical cupid's bow when the operation was well executed. As LeMesurier admitted himself:

Not all results have been as good as those in the photographs shown [in my book] but the high proportion of what could be called really good late results makes it seem justifiable for us to continue to do the same operations and to try to persuade others to do them.

Apart from its excessive tissue sacrifice, the theory of the Hagedorn-LeMesurier principle assumes the same dubious suppositions as did the Mirault principle: first, that the defect was actually in the lower portion of the lip and, second, that the main flap should be taken from the already deficient cleft side. Both suppositions are unsound.

From a practical viewpoint, the two most commonly expressed complaints of this approach over the years have been outlined by Washio in Stark’s *Cleft Palate*:

1. The scar in the midline of the upper lip is unnatural and therefore noticeable;
2. As the child grows, the lip on the cleft side becomes longer than on the normal side.

DeHaan also outlines the drawbacks:

Measurements made from the cleft side are arbitrary. Even a slight miscalculation in the size of the quadrilateral flap can make the lip too long or too short on the cleft side. . . . Yet we know of no other repair in which a greater amount of tissue is sacrificed. . . . Finally, what appears to be a good primary repair may later be disappointing since unequal growth on the two sides may cause the lip on the cleft side to be too long vertically.

Musgrave also admits this same unpredictable development
of excess vertical length on the cleft side and gave me several examples to prove it.

In 1970 A. A. Kolesov of the Moscow Stomatological Institute dismissed the method of Hagedorn and LeMesurier with

The lengthening of the lip is obtained by the transposition of a quadrilateral flap, patterned on the cleft side. LeMesurier suggested a series of calculations for determining the length and width of the flap, depending on the degree of deformation of the tissues of the lip caused by the cleft. The method is anatomically inadequate. A quadrilateral flap is not very mobile and is inconvenient for an incomplete unilateral cleft, when great lengthening of the lip is not required.

Reichert of Germany noted in 1971 his and Widmaier's observations:

At our plastic surgery department in Stuttgart we used the LeMesurier's Technique because of its accuracy in producing a nicely shaped cupid's bow. But after a few years' follow-up, we nearly always observed a lengthening effect of the rotated square-angled flap at the lower border of the lip, which was rather difficult to correct.

MORE RADICAL MODIFICATIONS OF LeMESURIER

Trauner

In the old university town of Graz, Austria, which enjoys the charm of having a mountain rise out of its center capped by the remains of a nineteenth-century castle, there is Professor Richard Trauner, a poetic, sensitive, warmhearted man skilled in both oral and plastic surgery. He admitted:

I saw elder patients dreadfully disturbed because of their cleft disfigurations. It is natural that one should enjoy to do such work making lovable young creatures happier and to see them growing up joyous and not full of complexes.

Trauner, like most European surgeons, used Veau's lip procedure for many years. About 1940, discontented with the shortness of this straight-line closure, the drifting of the ala and the
shortness of the columella, he first developed his "Z-plasty at the entrance of the nose" as a corrective secondary procedure. The Trauner flap was cut along the vertical axis lateral to the cleft scar with its base superior and transposed horizontally across the nasal floor and columella base.

At the International Congress in Stockholm in 1955, Trauner presented his primary cleft lip method, which incorporated his transposition flap across the entrance of the nose plus the Hagedorn-LeMesurier principle in the lower portion of the lip.

There were assets in this radical tissue shifting, but these seem outweighed both by the completely unnatural position of the many scars and by the destruction of the normal vestige of a cupid's bow.

**Grignon**

There is one Frenchman still infatuated with the quadrilateral flap of LeMesurier in the lower portion of the lip. Jean-Lucien Grignon of Hôpital St.-Antoine, Paris, calls this the inferior lock in his "double lock" technique. At the 1973 Copenhagen Cleft Palate Congress he presented his modification after 12 years' evaluation noting that changes between the time of lip closure and puberty in the area of the septum and alveolar border had precipitated variation in design.

This brought us to mark the lip and the ala of the nose a little higher on the cleft side, creating a hypercorrection of the rolling-up of the nostril during the first operation. . . . Disconnect the ala base with nasal mucoperiosteum from the maxilla at the pyriform fossa. . . . This technique could be summarized as a "disinsertion" with a hyper rolling-up of the
ala, fixed in a notch at the base of the columella, associated with a transposition flap for the lower portion of the lip. . . Moreover, the variable depth of the sub-columella notch would allow to change upon request and without any previous geometrical calculations the desired height of the white lip.

Grignon in all honesty does admit:

It solves not all our problems and we experienced disappointing results in some cases . . . [15%].

His valiant effort to correct the flaring alar base shortcoming of the LeMesurier method is commendable and would be even more so were the quadrilateral flap worth the effort. Although his zealous “overkill” advancement of the flaring ala in the final diagram may appear slightly reminiscent of a Grand Guignol theatrical, his later results shown after puberty revealed reasonable symmetry with only a minimal overcorrection of the cleft-side nostril.

Wunderer

Siegfried Wunderer of the Vienna University Clinic, in 1963 at the Washington International Congress, grouped all Z-plasties under the Hagedorn principle, including Tennison’s triangle, Skoog’s double interdigitation and the rotation-advancement, which is the same type of trap into which others have fallen. Yet Wunderer, with his interest in etymology, subdivided clefts in an unusual way: narrow lip clefts (A), wide lip clefts (B) and those with rudimentary cupid’s bows (C). He then proceeded to report six years’ work on 170 cases using his modification of the Z-plasty adapted to his three varieties of clefts.
An interesting reversal of the LeMesurier plan was developed by Darrel Shaw over 20 years ago in Cleveland. In 1971 in Melbourne, Maes, Li, Richey and Shaw projected diagrams of Shaw’s design and noted:

In LeMesurier’s method, the cupid’s bow was surgically reconstructed, not preserved.

This is the basis of their design, and, according to them, a quadrangular flap from the medial side of the cleft containing the cupid’s bow is rotated into the lateral side of the cleft—a reverse LeMesurier. They noted less amount of tissue discard than in the LeMesurier procedure, utilization of preexisting cupid’s bow, height of the peak of the cupid’s bow on the cleft side not influenced by the incisions, natural pouting of the vermilion border, avoidance of droop of the cleft side of the lip and avoidance of contracture by stepladder scar.

Actually, Shaw’s ingenious approach is a sophisticated rendition of the original quadrilateral flap that Gustav Simon cut from the medial side. In its reversal it does offer improvements over the LeMesurier design in that it preserves the bow. Yet the line of the scar is unnatural, showing little regard for philtrum columns or dimple, and after 20 years with so few case results published, evaluation must be confined to theory.
In the summer of 1951, while a plastic surgery resident in Houston, I drove up to San Antonio to the Battle of the Flowers. San Antonio was the hometown of Charles Tennison, a disarming and seemingly easygoing "country boy" who had been operating on a number of lip clefts. He kindly invited me to his home and explained how he had been plagued by the upward contracture in the Negro of the more or less straight-line lip closure of the Blair-Brown method, because of which he had resorted to a Z-plasty and "some little ol' stitches." To facilitate the Z markings, he showed me his trick of bending a wire but made no mention of preserving the cupid's bow. In October 1951 at the meeting of the American Society of Plastic and Reconstructive Surgeons in Colorado Springs, Tennison presented his stencil method and demonstrated how the wire should be bent in three equal arms and placed on the cleft side of the lip for marking. Only half of the stencil was necessary to mark the medial side. It is reported that the results he showed, although quite good, were not a lot better than previously demonstrated by surgeons using the Hagedorn-LeMesurier principle.
Kerwin Marcks of Allentown, Pennsylvania, realized the true value of Tennison’s Z immediately and was excited about this preservation of the cupid’s bow. After the meeting, while en route to Honolulu, Tennison and Marcks had an absorbing discussion on cleft lip.

Later, in his 1952 publication, Tennison outlined the important factors:

1. Adequate muscle approximation with muscle of the lip brought into as nearly as possible the normal transverse alignment.
2. Good skin coverage of the lip with the suture line placed in such manner that subsequent contracture of the scar is reduced to a minimum.
3. The production of approximately normal anatomy of the lip with preservation of the “Cupid’s Bow.” Any minor residual deformity should be easily corrected.
4. A full red border of the lip with normal “Pouting” protrusion of the lower portion of the lip.
5. Adequate floor of the affected nostril and correction of as much of the nasal deformity as possible at the primary operation.
6. Elimination of as much undermining of the face as is consistent with good closure.
7. A simple means of arriving at the locations of incisions so that standardization of the procedure is possible.

**CARDOSA**

Independently and simultaneously with that of Tennison came the work of Duarte Cardosa, innovator and boatbuilder of São Paulo, Brazil. He also described a method for preservation of the cupid’s bow and noted:

In a remarkable number of cases, the so-called cupid’s bow is fairly individualized in the medial margin of the fissure. The usual techniques for repair of harelip disregard the preservation of the cupid’s bow.

His method was less sophisticated in its design. In fact, this
general approach is slightly reminiscent of a method credited to M. Jalaquier as early as 1880.

Plessier published a result of the Jalaquier method which revealed the surgeon's failure to place the cupid's bow correctly. This sometimes happens even with the Tennison markings when the surgeon does not understand the design.

M A R C K S ' S R E M A R K S

Tennison made no further effort to promote his method, to modify it or to give a later follow-up of his cases. Marcks, however, carried his banner in 1953 and did much to popularize the new principle for he felt the approach was "so different and so much more practical." He advised beginners to use the stencil to avoid inadvertently reversing the Z. Once "the pattern becomes mentally automatic" he preferred to measure and mark with calipers. He first noted an important landmark that is essential to the marking, cutting and fitting of the lip elements:

The mucocutaneous juncture of the normal lip is accompanied by a skin prominence running less than 1 mm. above and parallel to it. In the cleft lip it runs along both elements but disappears near the cleft, even though the mucocutaneous border continues for a variable distance more. For want of any name known to us, we choose to call this the "mucocutaneous ridge."
This ridge, or "white roll" as Gillies termed it, has become more important as the sophistication of this surgery increases. Marcks also noted:

The scar which enters the peak of the cupid's bow serves to accentuate this peak. Scar contracture at this point, within reason, is not objectionable. In the first several postoperative weeks, this point is sometimes rather markedly drawn up by scar. All of our cases have dropped to a normal level within several months, however, excepting those in which the variable flap was made too thin.

Marcks marked the Tennison-type Z-plasty and then varied the angles of the Z until they almost resembled those of the quadrilateral flap of LeMesurier. Like Brown and McDowell, Marcks considered the lip deficit a triangle at the inferior border of the lip which he felt was corrected by a triangular flap placed at the inferior position. His most recent diagrams clarify his markings for complete clefts.

**Medial element**

Point 1 is placed at the termination of the medial mucocutaneous ridge and point 2 in the skin of the columella ridge. Marcks calls the distance between 1 and 2 "caliper distance" (CD). Point 3 falls on an imaginary line between 1 and 2 and perpendicular to it, pointing off a triangular flap based superiorly. The length of the base of this flap he calls "base caliper" (BC).

**Lateral element**

Point 1' is placed at the termination of the lateral mucocutaneous ridge and point 2' on the extension of the alar ridge as close to the mucocutaneous border as possible. "Caliper distance" is arced from point 2' and "base caliper" is arced from point 1', and where these arcs cross is point 3'. The flaps are marked, then incised and finally fitted together with interdigitation of the mucous membranes.
If the distance from 1' to 2' is longer than caliper distance, a superior lateral triangle may have to be excised. If the distance from 1' to 2' is less than caliper distance, the lateral paring will have to be extended laterally.

In 1972, Marcks summarized:

For the past few years we have utilized equiangular flaps to simplify the markings. Some lips look very good and some are a trifle short, but none are long. Any angulation greater than a right angle could readily produce a longer lip or the extension beyond the normal philtrum ridge could be responsible for a longer lip. This should never be done.

Here are two excellent cases by Kerwin Marcks which show the best that this approach can achieve. The cupid's bow is down and reasonably well balanced. The nose has been improved. The only possible objection is the unnatural position of the fine scars, which do not imitate the philtrum column of the normal side as they encroach on the philtrum dimple.

OBUKHOVA

Several years after Tennison, Cardosa and Marcks, Lidiya Maksimovna Obukhova, highly respected by her colleagues and honored by her country with the Order of Lenin, pioneered the inferior triangular flap and preservation of the cupid's bow in Russia. In 1957 she published a report of an operation similar in principle to that of Tennison but adding an enlarged Collis-Blair type of lip flap for reconstruction of the nasal floor. In
the 1958 scientific works of the Samarkand Medical Institute, Obukhova reconfirmed her faith in this method and mentioned its correction of the nasal ala and the important double closure of the nasal cavity and alveolar cleft.

Today, at the age of 75, L. M. Obukhova, whose early work continues to influence some of the younger Soviet cleft lip surgeons, is still an active operator in Samarkand and has a doctor daughter who is carrying on her work.

**A N O T H E R  R U S S I A N  R E N D I T I O N**

A. A. Kolesov of the surgical division of the Pediatric Department of the Moscow Medical Stomatological Institute in 1970, for a handbook put out by the U.S.S.R. Ministry of Health as a standard textbook for students of stomatology, divided modern lip methods into three groups: linear closures, triangular flaps and the quadrilateral flap. He dismissed the first and last groups. In his expression of preference for the methods of Tennison and Obukhova, he noted the possibility of obtaining any lengthening needed, depending on the size of the triangular flap borrowed from the cleft side, and the potential for precise planning which simplifies its adoption by young specialists. He did acknowledge that, in interrupting the philtrum,

The transverse direction of the post-operative scar lessens the cosmetic result of the operation.

He nevertheless recommended this type of operation for incomplete clefts without nasal deformity.

For clefts with nasal distortion, Kolesov used Limberg’s
method of measuring, which is sound for almost any lip operation.

He then combined Obukhova’s inferior triangular flap with Limberg’s superior triangular flap to the nasal floor. In actual priority, this is merely a marriage between Tennison’s principle and Collis’ flap, which Obukhova combined in 1957 and Randall simplified in 1958.

Kolesov’s excision and discard of a triangle of valuable lip tissue (lined transversely), as he described, “between the triangular flaps of Limberg and Obukhova,” is uneconomical, and the scar interruption of natural lines presents the same objections already applicable in earlier cases with similar methods.
HAGERTY

Robert Hagerty, in spite of his Bostonian brogue, after training with Peer and remembering southern hospitality at Duke University School of Medicine during his student days, turned south and settled in Charleston. In 1958, at the University of South Carolina, he described an inferiorly placed lip flap similar to Tennison's which interdigitated a small triangular flap from the cleft side to dovetail into an inferior cupid's bow releasing incision on the medial side. His plan was a little complicated, with the normal side \( A \) to \( B = A'' \) to \( B'' + \) width of flap \( X' = A' \) to \( B' + \) width of the dart \( X \). He dropped a dotted line from the mid-columellar base to the center of the bow and joined this with a second dotted line extending perpendicularly from the height of the bow on the cleft side. The position of the dart was determined by bisecting the distance from the intersection of the vertical and horizontal dotted lines to the center of the bow. Actually, Hagerty is a great fellow, both in stature and in person, and more uncomplicated than the intricate planning of this design would indicate.

RANDALL

Peter Randall, at the University of Pennsylvania in 1959, did to the Tennison-Marcks principle what Brown and McDowell did to the Mirault-Blair: He simplified and reduced the size of the triangular flap. As he said,

The flaps used by both of these surgeons (C. W. T. and K. M.) are quite large and although these are shown to produce excellent results in children with wide defects, in narrower clefts it would seem that a much smaller flap could be used to better advantage.
Randall, the master of measurements, reduced this lip design to a mathematical pattern and was awarded an Honorable Mention prize in the Foundation Essay Contest for his work and numbered markings.

1. Marking the superior peaks of the cupid’s bow on the cleft and the non-cleft side (3,8).
2. Measuring the vertical height on the non-cleft side from the base of the columella to the superior peak of the cupid’s bow (4–2).
4. Determining the difference between these two measurements (4–2 minus 5–10) which will be the distance across the lateral triangular flap (11–8)—or the distance the cleft side of the cupid’s bow must be brought down to bring it into normal position.

Points 2 and 3 mark the peaks of the bow, and 4, 5 and 6 are the same as in the Brown-McDowell design; 5–3 is marked, and then 3–7 is extended about at a right angle but never past the line 4–2. The difference between 4–2 and 5–10 should equal the distance across the lateral triangular flap 8–11. Point 12 is picked so that 12–8 equals 12–9. The position of 12 is determined by the tissue available. Tissue medial to 8–12–9–6 is discarded. A small triangular flap at the base of the ala, similar to that of Collis and Blair, is fitted into an incision inside the base of the columella.

Randall noted in 1971:

After 14 years of use the only change has been that the triangular flap is made no wider than 4 mm. in the infant.

For his example Randall chose and sent me what appears to have been an incomplete (halfway) cleft which is somewhat difficult to evaluate because of the photographic shadows. It is a case he first published in Plastic and Reconstructive Surgery in April 1959. After 14 years, a submucous resection and a vermilion surgical touch-up, the case exemplifies an excellent result of the small inferior triangular flap. One cannot but be concerned that the design plans such a large amount of tissue discard. The zigzag scar across the normal philtrum column may catch the eye under certain lighting, and its low insertion tends to smooth out the
dimple, but because of the reduction in size of the flap the unnatural effect seems to be less noticeable. The nose, which was not severely deformed, is improved but still retains some of its original asymmetry.

Recently Randall presented me with another incomplete cleft with an eight-year follow-up. Although the flat lighting hides half of the fine scar in a result that is quite pleasing, the zigzag across the philtrum is discernible.

In 1971 I learned several of the secrets of Peter Randall’s success. In the backyard of his Georgian home, built by his father in the Chestnut Hill area of old Philadelphia, he has two important landmarks most useful in summer. One is a large smokehouse apple tree in the shade of which he can contemplate numerical lip points. The other is a horse trough which he and Posey fill with beer and ice for friends who come to help her distract him from his numbers racket.

And so, two Pennsylvanians not only embraced the Texan Tennison principle but improved it, each in his own way and not without discourse between themselves. Kerwin Marcks, of
Dutch descent, short of stature, large of heart, is always game for a joke. He called up Peter Randall one night and, in an attempted change of voice, said:

"Dr. Randall, this is Dr. Schniggelfritz and I have a baby with a cleft lip. Do you do this type of case?"

"Yes, Doctor . . . er . . . Schniggelfritz, I am very interested in cleft work."

"Well, Doctor, that is interesting. Have you heard of a Dr. Kerwin Marcks? Is he any good?"

"Why yes, I know Dr. Marcks and he is very good."

"But Doctor, he's getting on in years. I've heard he may be a bit senile."

By now, Randall was on to Marcks’ ruse and answered:

"Dr. Marcks is mature but all the more experienced, Dr. Schniggelfritz!"

And they both had a good laugh.

**TRAUNER CHANGES**

Meanwhile Trauner, who combined his “Z-plasty at the entrance of the nose” with the LeMesurier method, began to find the lip on the cleft side often becoming too long. With the introduction of the Tennison Z principle and later Randall’s reduced version, Trauner, appreciating the value of preserving the natural bow, substituted Tennison-Randall for LeMesurier in the lower portion of the lip. In his diagrams $AB = A'B'$ and $BC = B'C'$. He also overlapped the non-cleft side with vermilion from the cleft side and turned a larger septal flap across the floor of the nose to maintain the release of the alar base from the maxilla.
This patient operated on by Professor Trauner shows the early healing phase and the result at eight years.

In 1972 in Miami, Trauner noted that this change did not produce as strong a cupid’s bow but the one preserved was more natural. He also reported to us that 50 percent of his noses, after his primary surgery, resulted in a symmetrical nasal tip. His many years of experience prompted him to conclude that scars improve so much with time that secondary corrections should be postponed for years.

A Z FRANÇAIS

The gentle Professor Pierre Petit of Hôpital Saint-Vincent de Paul, Paris, was one of Veau’s favorite students and carried on the master’s great work. In 1961, with Borde and Malek, he described his rendition of the Tennison triangular flap procedure, claiming it to be "une solution mathématiquement parfaite." Two designs were presented. Design A marked the medial flap 7-3-5 with an angle of 60 degrees and the base above, while the lateral equilateral flap 8-10-9 had its base below. The transposition of these two flaps lengthened the cleft edge to equal the normal distance from 2 to 4.
To improve the position of the alar base design, B reversed the position of the bases of the two flaps. Here again, the sum of the width of the two flaps' bases equaled the normal distance from 2 to 4.

In 1972 Petit wrote me of modification C, which combines Trauner and Tennison somewhat as Skoog combined them. He explained it this way.

If the hypoplasia of the lip is too marked then two triangular flaps on the lateral border of the cleft are determined geometrically as with the other designs. The double Z provides a double advantage—it gives a good inrolling of the nose and a good release of the lip "avec un très bon arc de cupidon."

He also explained that he continues to close the anterior palate at the time of lip closure as Veau did but using only the naso-vomerine layer without the overlapping mucoperiosteal flap.

This method for Petit offers the security of geometric accuracy but as in all Tennison-type Z's, the cupid's bow is positioned at the cost of scars crossing natural lines and destroying or encroaching upon the philtrum dimple.
SIMPLE Z

Some surgeons varied their use of the Z-plasty principle by paring the cleft edges first and then marking and cutting the Z in the primary operation, preserving the cupid’s bow in the process.

Perseu Castro de Lemos of Recife, Brazil, in 1956 and again at the Congress in Rome in 1967, advocated freshening of the cleft edges, preserving the residual cupid’s bow plus a Z-plasty which he called cheilo “Z” plasty.

Victor Spina of São Paulo, with O. Lodovici in 1960, also designed a straight-line paring of the cleft edges, and they too had the sophistication to preserve the residual cupid’s bow. Then they lengthened the vertical height of the short cleft side with a Z-plasty. An interesting aspect of their plan was the denudation of the excess vermilion flap from the cleft side used to bolster the non-cleft side.

MANY JOIN THE RANKS

The obvious value of preserving the cupid’s bow was responsible, along with the many minor modifications, for the gain in popularity of Tennison’s principle. Lewin’s study in 1962 revealed that the Hagedorn-LeMesurier method was used by 42.8 percent of American and Canadian surgeons and that the Tennison-Randall was coming up fast with 37.4 percent.
OHMORI

Ohmori of Japan in 1963 expressed appreciation for the Z as an improvement over the straight-line closure:

In the past the surgical treatment of primary cleft lip consisted of hand massage to the cleft lip area to bring elongation of the cleft lip and then the defect was sutured in a straight line. The results of this procedure were, in almost all cases, very poor. Today we usually apply the triangular flap method to repair the cleft lip.

BOSTON BRAD

Some surgeons were so overjoyed to get a bow that they accepted the zigzag scar with a cavalier attitude. Bradford Cannon of the Massachusetts General Hospital discounted this disadvantage in the Medical Intelligence section of the New England Journal of Medicine with

The angular scar is inoffensive.

Inoffensive to whom?!

WANG

Mark Wang, at the Albany Medical College in 1960, tried to combine the best of LeMesurier and Tennison. He claimed:

The normal cupid's bow is preserved and, by the use of a quadrilateral flap, the advantages of accurate predetermination of the final length of the repaired side, stepladder suture line and, finally, the central protrusion of the upper lip are retained.
According to Wang:

The measure of a successful congenital cleft lip repair is not in the immediate result but how well cosmetically and functionally it keeps pace with the growth of the patient.

He has saved the cupid’s bow, which is good, and his broken-line closure reduces contracture but presents an unnatural line. Of greater concern to Wang must be the threat of his quadrilateral flap’s simulating that of LeMesurier with gradual unattractive elongation of the cleft side of the lip with growth.

Soon after Wang combined LeMesurier and Tennison, two British plastic surgeons, Joss and Rouillard, in 1962 gave their criticisms of the LeMesurier, Tennison and Randall procedures:

Randall has described a modification of Tennison's method whereby the lip markings are drawn and equated mathematically, but this is not felt to be an advantage over the simple but effective bent wire technique. . . . Whatever the operator’s preference in regard to skin marking, the incisions once made are irrevocable (particularly with the LeMesurier repair) and mistakes become magnified as the child grows. One major criticism which seems justified in both LeMesurier's and Tennison’s methods is that the nasal deformity is only partly corrected, the Z-plasty being essentially in the lower half of the lip.

DAVIES

In Cape Town, South Africa, nestled on the other side of Table Mountain from the harbor, is Groote Schuur Hospital, the site of Barnard’s first cardiac transplant. Here also, and at the University of Cape Town, is the dashing David Davies, son of another plastic surgeon, David Davies, Sr. In 1965 Davies presented a simple method for utilizing two equal flaps of a pure Z-plasty to give a predetermined height of the lip on the cleft side. He advocated the use of various-sized steel triangles with handles attached to aid in the systematic marking of the flaps. Having done so many operations, he now seldom bothers with metal flap markers but measures first the height of the lip on the normal side (2–4). He then marks two equilateral triangles,
5-3-9 and 6-7-8. On the basis that a Z-plasty made with 60 degree angles will cause an increase of length along the main axis of 75 percent, each limb must be four-sevenths of the normal (2-4) distance in order to achieve a final lip length on the cleft side exactly equal to that on the normal side. In other words, if the two flaps are marked with an angle of 60 degrees with a length of 1 cm., the final lip length will end up 1.75 cm. Or when the lip is operated on at three months, the length of the normal side is usually about 1 cm., which calls for triangles of 0.58 cm.

Of course, more tissue has to be discarded in incomplete clefts to ensure perfect lip length.

Davies prefers the full Z-plasty for the complete cleft. In 1971 he admitted that the most common criticism has been that the horizontal limb of the Z-plasty crosses the area of the philtral ridge on the cleft side. He feels that the ascending Z-plasty limb is rarely noticeable and often mimics a philtrum ridge. The horizontal limb often fades well, he claims, but he admits:

The most troublesome and noticeable part of the scar is the point and superior ascending limb of the Z-plasty. It sometimes has a tendency to form a miniature trapdoor or bridle scar.

One case forwarded to me by Davies had been photographed with strong crosslighting, revealing a good lip even without preservation of its philtrum dimple. The light exposure had softened the effect of his obviously excellent scar crisscrossing the philtrum column line. His accompanying comments were pertinent:
However, there is still flattening of the nose on the affected side and the indirect lighting across the lip brings out an annoying facet of the Z-plasty which often manifests itself no matter how careful one's technique and that is the slight raised prominence of the tip of the upper flap. I make a point now of snuggling this tip well down into the apex of the V with a subcuticular stitch in order to prevent this rising up postoperatively.

In spite of his own criticisms, he produces, in my opinion, lip results as good as if not the best of those achieved by any variation of the Z-plasty. Perhaps because he is a bit closer to the rotation-advancement in the placement of his scars?

**C R O N I N**

Concerned about the unreliability of getting a good join across the cleft at the mucocutaneous line, Thomas Cronin in 1966 made a slight modification in the Tennison-type lip closure. He lifts his medial transverse incision, CB, 1 mm. above the potential peak of the bow on the cleft side from E to D. On the lateral side again he raises his flap 1 mm. above the edge from E' to D'. Then a vertical cut is made across each mucocutaneous ridge to facilitate the alignment of the vermilion border. In essence, the slightly elevated lateral triangular flap is let in slightly above the mucocutaneous ridge on the medial side in a short straight-line join. Brauer subsequently joined Cronin in this 1 mm. jog.
POPULARITY OF THE Z

In 1959 Raymond Brauer, after having previously embraced and modified the LeMesurier method, concluded that Tennison's method was superior in unilateral primary clefts for the following reasons:

1) It saves the cupid's bow, the medial half of which is sacrificed by LeMesurier's incisions as indicated by the stippling.
2) It relieves vertical shortness of the lip on the cleft side in the body of the lip, rather than merely in the lower third.
3) The scar falls laterally where it is far less noticeable than is a central scar which distorts the cupid's bow and displaces laterally.

On the bus to the teaching sessions at the American Society of Plastic and Reconstructive Surgeons meeting in Las Vegas in 1972, I challenged Brauer:

"Ray, I think you persist in cutting a Z-plasty in the lower portion of the lip out of some old resentment from my residency days in Houston."

He laughed and said:

"No, but if you have a contracture at the elbow a Z-plasty placed directly in the antecubital space gives easier release than one higher on the arm."

Easier maybe, but ease is not our most important factor. An entire displaced component, it would seem, should be moved as a whole and not be "drawn and quartered."

It has been said that Brauer's lips rank among the best. I asked him to send me examples, preferably complete clefts with long-term follow-ups. Here is an example which shows Brauer's markings on an incomplete cleft, the early result and a later follow-up of the Z.
Another fine example is used to demonstrate an important point. The photo of the original deformity reveals not only a complete cleft but a predictable longer-than-ideal vertical lip length on the normal side. Brauer executed his neat inferior triangular interdigitation without transgressing or affecting the normal side. He achieved good positioning of the bow, but, as could be foretold, the total vertical lip length eventually appears longer than ideal. This is not the fault of the method but the result of matching the cleft to the long normal side.

The question arises: Should we shorten the long normal side rather than knock ourselves out lengthening the short cleft side in those rare cases with a predictable long lip future?!

CLIFFORD AND POOL

In Detroit in 1957, with the aid of a blackboard in a small room on the thirteenth floor of the Henry Ford Hospital Clinic, Drs. Robert Clifford, Pool, Kelly and Kislov hotly debated the pros and cons of the various popular cleft lip techniques. They measured hundreds of infants' lips in the adjacent clinic and sketched and erased thousands of drawings in a constant blackboard battle. Finally, in 1959, young Pool presented their findings to the American Association of Plastic Surgeons in Boston. Included was a probing comparative analysis of the LeMesurier and Tennison methods illustrated by a composite drawing. He commented on

the tissue used in the triangular [Tennison] flap repair [dotted line] and sacrificed in the square [LeMesurier] flap repair [dark line]. Square versus triangular flap: the square flap technique sacrifices vermilion and remnant of cupid's bow on the cleft side of the midpoint. Likewise, when the oblique incision is past the midline or through the philtrum, the lip will be made
long and tight. The only tissue sacrificed in triangular flap repair is the skin above this flap. . . . One definite disadvantage in the use of the quadrilateral flap repair is that it is generally planned from the cleft side with a preconceived idea of lip height. When an error is made it is usually in the direction of excess length with concomitant horizontal tightness and sacrifice of the useful normal remnants of cupid’s bow, midline dimple and midline tubercle.

Pool recalls now with nostalgia how, during his presentation, six authors of plastic surgery textbooks, with much experience in cleft lip surgery, sat in the front row. Although the previous papers had been vigorously challenged, when he finished and waited in anticipation for discussion, the audience got up, turned around and left the room for intermission without one word. As he says today,

It was rather like a nightmare and I left the room feeling that I had laid a colossal egg.

To add to this blow, only 36 hours later Robert H. Clifford, his chief and friend, died. Actually, their analytic study stands as an important landmark in cleft surgery.

Although more conservative of landmarks and tissue than the square flap, the triangular flap is by no means as simon-pure as Clifford and Pool indicated.

Musgrave in 1964 felt that the Tennison technique is easy to teach, easy to perform and best suited for the severe degree of incomplete cleft lip and for most complete clefts. He suggested:

In the complete unilateral cleft lip, when possible, an attempt is made to plot the triangular flap on the lateral elements of the lip, as long as the markings can be maintained within the lateral nasal crease where the ala joins the lip. When this is not feasible and it appears that the incision would extend too far laterally, the Tennison method is not used and instead a quadrilateral flap is planned.

INCREASE IN VERTICAL LENGTH

Surgeons have noted, as with the quadrilateral flap of LeMesurier, that the triangular flap of Tennison also results in increase in
vertical lip length on the cleft side in certain cases. Pool attributed this outcome to a vertically long lateral element. Brauer and Cronin purposely made the lip shorter by one or two millimeters initially to compensate for the subsequent increase in vertical height.

Musgrave with Garrett for Goldwyn’s 1972 book, *The Unfavorable Result in Plastic Surgery*, noted:

The surgeon who chooses to use one of the lateral flap methods, i.e., either a rectangular or triangular flap introduced just above the vermilion border, should be aware that in the patient with a wide cleft, this rotated tissue which originally was cheek tissue has been turned downward and medially to be inserted into the medial border of the cleft. With time, the lip may well become too long. It behooves the surgeon, therefore, who is considering use of such a flap method (LeMesurier, Wang, Hagerty, Randall, Tennison) to be alert to such potential lengthening and to plan a lip that is approximately 1 mm. on the short side.

**SIMPLIFYING THE DESIGN**

Chandler Sawhney of Chandigarh, India, considers the increase in vertical lip length to be due to faulty design rather than abnormal growth. He does admit that a small error at time of operation is likely to become more apparent as the lip grows and the scar stretches. In 1972 he proposed a simple, logical way to design and measure the Tennison method. A transverse incision across the philtrum which stops at the midline will drop the cupid’s bow into symmetry. Taking the difference in height of the peaks of the bow on the cleft and normal sides after pushing the columella into straight position determines both the amount of drop on the medial side and the width of the triangular flap on the cleft side. Of course, these two are equal to each other.
The Tennison principle and all of its subsequent modifications made one important advancement, the preservation of the cupid's bow and its placement into normal position. This had been accomplished by taking a triangular flap from the cleft side to insert into an inferior releasing incision on the non-cleft side. In fact, this means does not justify the end; too many proved principles are being ignored.

1. Like the Mirault modifications this method also bases its logic on the false supposition that the actual defect in the cleft is in the lower one-third of the lip. This, of course, is not the case.

2. The main triangular flap is taken from the deficient cleft side, and in principle it is unwise to borrow from Peter to pay Paul when Peter can ill afford it.

3. There is already missing tissue so that further discard of tissue is unsound in principle. It is particularly extravagant in incomplete clefts with the Tennison approach.

4. Nasal correction by this approach is not simultaneous but requires a separate action. The straight-line scar of the upper portion of the closure runs directly into the floor of the nose, a telltale sign of cleft lip. The short-sided columella remains short, no nostril sill is created and, in order to move the alar base far enough medially, more excision of tissue is necessary.

5. Probably the most important flaw in this approach is the Z-plasty in the lower portion of the lip. It crisscrosses Langer's lines, violating the potential vertical philtrum column and disrupting the philtrum dimple. Even when the scars heal superbly, the result is unnatural. When the scars are poor, the effect is unacceptable. Photographs of results in which flat lighting has wiped out the scars completely are misleading.

Of the cases that come through our clinic, those that have been treated according to the Tennison design often are reasonably good. The unnatural zigzag of the scar is the only aspect
that is universally offensive. Of course, when the surgery has
not been carefully executed, the secondary correction can be
exceedingly troublesome.

Or, as paraphrased by Professor R. L. Last:

Seven times seven turn your knife in your hand
Ere you cut the skin of a fellow man.
Seven times seven and go out to dine
Ere you cut across a Langer's line.