

## Converse: Chapter 43

### THE UNILATERAL CLEFT LIP

Ross H. Musgrave, William S. Garrett, Jr.

#### HISTORY

The wide distribution of clefts in lower animals suggests that cleft lip is a disease older than man himself. It is unfortunate that our knowledge of the early evolution of lip repair is extremely sketchy. Undoubtedly the first sporadic attempts at approximating the raw edges of a cleft went unrecorded. Celsus, the first century Roman dilettante who was an encyclopedist and not a surgeon (Garrison, 1968), is generally credited with the first description of a cleft lip repair. Although Velpeau (1851) considered this description "obscure" and Barsky (1964), after his own study of original texts, concluded that Celsus actually was reporting of traumatic rather than congenital cleft, the writings of Celsus nevertheless mark the entry into the classical literature of at least cursory references to the repair of lip defects. By the tenth century, mention of lip repair had crept into Old English writings. Bald's *Leech-Book*, a compilation of folk medicine produced at Winchester about A.D. 950, described cutting the "false edge" of a harelip and suturing the wound with silk. Subsequently a salve of mastic and egg was applied (Cockayne, 1961).

According to Garrison (1968), the fourteenth century Flemish surgeon Jean Yperman gave a "good account of ... (the) healing of harelip", but Barsky (1964) considered Pierre Franco, a sixteenth century French surgeon living in Switzerland, to be "the father of cleft lip surgery". Franco in 1556 and 1561 published an unmistakably clear description of an operation for congenital cleft lip. His text included succinct observations on physical findings, surgical techniques (including mucous membrane relaxing incisions), and postoperative care. Franco even used the term "cleft lip" in contrast to his contemporary Ambroise Pare, who in his brief discussion of the same subject in 1568 spoke of "harelip". In principle the only criticism of Franco is his advocacy of surgical resection of the protruding premaxilla.

Despite the advances made by Renaissance surgeons, cleft lip repair remained crude, until the advent of anesthesia and asepsis in the nineteenth century permitted the development of complex incisions and refined suture techniques. As a step forward from the simple paring of the cleft edges (actually V-excision), several surgeons recommended curving or angulating the denuding incisions to provide for increased length of the sutured lip. According to Lexer (1904), Graefe in 1825 advocated the use of curved incisions to overcome notching and shortening in the line of repair. In 1844 Malgaigne first described the use of angular incisions to produce even greater lengthening. (Lexer stated that Clemat previously had practiced but not published this method.) In 1844 Mirault published his method for repair of complete unilateral cleft lip by creating tiny vermilion flaps on either side of the cleft and then discarding one of them during the suture approximation of the cleft edges. Mirault's description of his operation was so poor that there is controversy about the details (Padgett and Stephenson, 1948); nevertheless, the flap operation was a fundamental advance which led the way to the Blair-Brown-McDowell repair. Operations similar to Mirault's procedure were described by Meleux, Mirault's successor as chief surgeon at the medical school in Angers, and by Jalaguier, Veau's teacher (Veau, 1938).

In 1868 Collis described an operation which ended in a scar not unlike that of the Mirault procedure. However, in the Collis operation a small flap of skin and mucous membrane was used to build up the floor of the nose and to roll in the flared alar base. Thompson (1912) pointed out that this small flap frequently brought bright red mucosa into a conspicuous spot in the nostril floor.

In 1891 Rose used curved incisions extending from the nostril floor to the vermilion border in order to give a line of repair sufficiently long to maintain lip symmetry and still salvage good vermilion adjacent to the Cupid's bow. Rose described closure of the wound in two layers with catgut and wire. In a thoroughly delightful monograph, Thompson (1912) described similar, but angulated, incisions that were made with the help of caliper measurement. Thompson discussed the various cleft operations then in vogue and presented his own versions of the actual results. He irreverently concluded that most of the procedures looked better on a sketch pad than they did on a patient.

Apparently scar contracture was a fairly common complication after many of these early operations. Therefore, the late nineteenth century surgeons devised several methods to produce an irregularly patterned scar. The procedure described by Owen (1904) resulted in an angulated suture line running laterally but had the defect of discarding excessive amounts of the lateral vermilion. The Koenig operation (1898), like that of Owen, introduced tissue from the medial side of the lip into the lateral side, producing something of a reversed LeMesurier rectangular flap. It must soon have become apparent that moving tissue from the deficient medial side of the cleft into the already somewhat full lateral side was illogical. Therefore, emphasis shifted toward the augmentation of the medial segment with flaps taken from the lateral segment.

In 1892 Hagedorn described what many consider to be the forerunner of the present day rectangular flap. Hagedorn's operation produced a desirable fullness at the vermilion border. Veau (1938) stated that Jalaguier in 1910 described a procedure which also brought lateral tissue to the area of medial deficiency. Jalaguier's design was defective, however, because it discarded too much vermilion from the lateral portion of the lip. In 1930 Blair and Brown described a flap one-half the length of the lip which was constructed from tissue lateral to the cleft and was introduced medially to fill a triangular defect. These authors deserve the credit for insisting upon the construction of a pouting lip and the correction of the nostril deformity. As a result of this well-written and well-illustrated presentation, the Blair-Brown procedure became the operation of choice throughout many parts of the world. Subsequently, Brown and McDowell (1950) modified the operation by substituting a smaller flap. The Blair-Brown-McDowell operation is considered to be a descendant of the Mirault.

In the mid-thirties LeMesurier (1962) devised a rectangular flap operation related to the Hagedorn repair. Although LeMesurier did not publish his method until 1949, when he was able to report on 13 years of experience, many plastic surgeons knew of his work by personal communication and adopted the method before it appeared in the literature. Steffensen in 1949 presented his results with the rectangular flap and demonstrated the applicability of this repair to all unilateral clefts. Although both the Hagedorn and the LeMesurier operations produced a Cupid's bow, it was a synthetic one, depending upon the degree of inclination of the lateral incision toward the vermilion-cutaneous ridge for its configuration.

In 1952 Tennison introduced a repair using a triangular flap outlined with a bent wire stencil, a method which impressed many surgeons with its good results and simple design. One of the selling points of this operation was the preservation of the normal Cupid's bow present on the medial lip segment, or prolabium, a landmark previously ignored. Marcks, Trevaskis, and da Costa in 1953 clarified the technique and discarded the wire stencil. Hagerty (1958), Randall (1959), and Cronin (1966) have added modifications to the triangular flap insert. In 1958 Skoog described a repair employing two smaller triangles and gave credit in principle to Trauner and Gillies (although actually the small turn-in flap at the floor of the nostril was present in the Collis operation of 1868). The introduction of a lateral triangle not at the vermilion-cutaneous ridge but high in the lip near the base of the columella was suggested by Millard in 1955. In Millard's operation the medial segment is lengthened by downward rotation, and the resulting defect is filled by an advancement flap from the lateral portion of the lip. In effect a Z-plasty is produced, a pattern also evident to greater or lesser degree in other lip repairs. The Z-plasty principle in cleft lip surgery up to 1959 was reviewed by Clifford and Poole (1959). More recently, two new Z-plasty repairs have been introduced. One, the repair of Jayapathy, Huffman, and Lierle (1960), utilizes a low, medially based flap inserted just above the vermilion-cutaneous ridge laterally; the other, the Davies (1965) operation, is not unlike the original repair of Tennison. Trauner and Trauner (1967) and Wynn (1965) have presented procedures employing sizable, elongated, superiorly based lateral pedicles which are rotated into the upper portion of the medial segment (cf. Millard, who advances rather than rotates the lateral flap). In addition to the superiorly based lateral pedicle, Trauner also used a small, lateral triangular flap inserted into the medial segment just above the vermilion-cutaneous ridge. Trauner has called his method a combination of the Tennison and Millard operations, although in actuality it is more of a combination of the Tennison and Wynn operations.

## TREATMENT

**Preoperative Feeding.** Infants with isolated cleft lip seldom present feeding problems. On the other hand, babies with cleft lip and palate or isolated cleft palate are likely to require special attention if they are to be adequately nourished. The problems that arise are seldom major ones, and fortunately most can be solved with patience and care. Hospitalization is rarely required. In order to minimize aspiration and nasal regurgitation of food, it is helpful during feeding to hold the baby at an angle of 45 to 60 degrees from the horizontal. To overcome the infant's inability to suck properly, numerous feeders have been devised. The simplest one is a very soft, frequently boiled, rubber nipple with a slightly enlarged hole. Premie and duck bill nipples may be useful alternatives. The authors feel that the most satisfactory feeder is one employing a collapsible plastic reservoir bag that can be squeezed cautiously to assist the baby who finds sucking difficult. Restaurant-type plastic catsup dispensers, which are equipped with small nozzles, have also been successfully used. For the patient with a severe feeding problem, a bulb syringe fitted with a catheter tip may be required. No matter what method is employed, great care must be taken not to flood the pharynx and thereby provoke aspiration. It should be noted that the infant with a major cleft tends to swallow an increased amount of air and therefore must be burped more frequently than the normal child. Usually parents are quick to adjust to the feeding idiosyncrasies of their children, and each family works out its own technique for each child.

**Timing of the Operation.** Selection of a suitable time for lip surgery varies from surgeon and from clinic to clinic. In some parts of the world infants are operated upon under

local anesthesia during the first 48 hours of life. If the newborn child is generally healthy and of normal weight, this early operation seems to be successful in skilled hands. Early surgery offers the obvious advantage of enabling families to take home children who do not have wide-open clefts. It has also been suggested that early surgery minimizes feeding problems, a point the authors think has been overemphasized.

Many surgeons delay lip repair until ten weeks following birth. By this time the lip structures have increased in size, providing the surgeon with larger tissues upon which to work. In addition, ample time has elapsed to permit complete evaluation of the general status of the infant. An important ancillary factor favoring delay is the conviction of many surgeons that parents who have lived with an untreated cleft patient for several weeks gain insight and are better prepared to deal with the vicissitudes that cleft repair and rehabilitation often present. The authors prefer to delay lip repair until the infant is gaining weight and has a normal blood cell count. There is an old aphorism called "the rule of tens" which states that surgery should be delayed until the infant weighs ten pounds, has a hemoglobin of 10 grams and a white blood cell count below 10,000, and is at least 10 weeks old. The validity of this rule has been demonstrated by Wilhelmsen and Musgrave (1966).

**Anesthesia.** Preoperatively a complete physical examination is performed and the routine complete blood counts and urinalysis are obtained. Surgery is delayed if the laboratory studies are abnormal or if an acute intercurrent disease, such as a respiratory tract infection, is present. Only rarely are blood transfusions employed. The infant with an iron deficiency anaemia is placed on corrective medication and surgery is delayed until the haemoglobin is above 10 grams.

General anaesthesia remains a major hazard in cleft lip repair in small infants, and the surgeon should be aware of this fact, even though advances of the past two decades have reduced the anesthesia risk to impressively low statistical levels in most hospitals. When general anesthesia is selected, a carefully placed endotracheal tube of proper size is used. Pharyngeal packs should not be necessary. If a leak occurs, a larger endotracheal tube is inserted. Tubes with inflatable cuffs are not used in these infants.

The anesthetic agent used should be selected in consultation with the anesthesiologist. In the past ether was used almost universally with excellent results. However, there is now a trend away from the use of flammable anesthetics. In the USA halothane (Fluothane) and methoxyflurane (Penthrane) are in widespread use. In England Rees (1960) has employed thiopental induction followed by maintenance with a muscle relaxant, nitrous oxide, and hyperventilation, a method known widely as the "Liverpool technique".

Because many surgeons inject epinephrine solution into the operative area for hemostatic effect, the use of halothane for lip repair has been questioned in the past. Each anesthesia service must determine its own policy, but for the past several years at the Children's Hospital of Pittsburgh, the authors have used 0.3 ml of 1:200,000 epinephrine solution per kilogram of body weight and have encountered no ill effects. Minute amounts of epinephrine are effective, and we seldom need to use the total amount allotted. Puffing up the tissues with large amounts of infiltrated epinephrine solution is not necessary and is undesirable in the sight methods of repair, such as those of Millard.

**Positioning and Marking of the Patient.** The positioning selected by the surgeon depends upon whether he is left- or right-handed and, perhaps even more, on what the habits of his teachers were. The authors prefer to have the anesthetized patient elevated on folded bath blankets with the head slightly extended. The anesthesiologist sits on the child's left side facing the head of the table so that he can use his left hand to monitor respirations under the drapes and manipulate the rebreathing bag. The orotracheal tube is taped carefully into place in the very center of the lower lip so as to produce no lateral distortion. An ophthalmic ointment is placed in the eyes as soon as the child is anesthetized in order to protect against corneal injury from skin preparations and drapes. For additional protection strips of paper or plastic tape can be placed over the eyes to maintain the lids in the closed position. The skin and nostrils are gently cleansed with pHisoHex diluted in water. Iodine and the various topical alcohol solutions probably should be avoided because they can be damaging to skin and mucous membranes. Finally, the patient's head is draped with a double sterile towel. The surgeon now has free access to the head and right side of the table and can inspect the face from a variety of vantage points during the course of the operation. The authors tend to operate from the patient's right side but move around as circumstances dictate. A left-handed surgeon might prefer the mirror image of the above arrangement.

The final planning and actual skin marking should be studied both from the front, with the surgeon standing at the patient's side, and from above, with the surgeon standing at the head of the table. Whatever type of repair is used, pertinent points in the operative incision should be tattooed temporarily with a small, dye-tipped needle prior to the injection of epinephrine. Because epinephrine may cause blanching sufficient to obscure the vermilion-cutaneous junction, it is particularly valuable to have the white line (vermilion-cutaneous ridge) delineated by tattoo marks on each side. At certain key points it may be helpful to use double tattoo marks - one mark designed to lie precisely in the incision and hence likely to be destroyed, and the second mark designed to lie immediately adjacent to the incision where it will be available to help align strategic points for suture. Permanent tattooing has never been encountered on our service when methylene blue was used as the dye agent. Fine-pointed calipers and millimeter rulers are essential tools for the planning of the triangular and rectangular flap operations. These tools are less important for the sight methods, such as those of Millard and Rose-Thompson.

**Details in Surgical Technique.** It is essential that the tissues be cut sharply at right angles to the skin and mucous membrane surfaces with incisive strokes of the knife. A No. 15 Bard-Parker blade is recommended for the skin incision. Although the No. 11 blade is very useful for deepening the incision through the muscle and mucous membrane, its willowy tip may give a "feathered" edge to skin incisions. Bleeding points are grasped with mosquito hemostats and then after a short period are released. Occasionally larger vessels, such as the coronary artery, may require ligation with 6-0 chromic catgut or electrocoagulation if nonflammable anesthetic agents are being used.

The tissues must be handled gently if one is to obtain the ultimate in wound healing. The crushing use of forceps is condemned; careful handling with small skin hooks is encouraged. A fine-tipped suction apparatus may be useful in keeping the wound free of blood to provide a clear field of vision for the operator.

The choice of suture material depends upon individual preference. Silk, cotton, chromic and plain catgut, nylon, horsehair, and various wire sutures have been advocated. The

ideal suture material should be strong, fine, and pliable. For surface suturing the authors prefer 6-0 chromic catgut in the vermilion and 6-0 silk in the skin. We have found it helpful to approximate the vermilion-cutaneous ridge (white line of the Cupid's bow) with a meticulously placed 6-0 chromic catgut suture in the skin above. The placing of sutures in the ridge itself should be avoided, because even the faintest stitch mark can spoil this crucial landmark; the suture material should be loosely tied. There is an unfortunate tendency on the part of young surgeon to tie lip and palate sutures too snugly.

It is usually possible to execute a tension-free repair of the unilateral cleft with minimal dissection of the cheek from the maxilla. If the surgeon believes that repair without tension is going to be difficult, he would be wise to consider a preliminary lip adhesion operation.

**Dressings.** Many surgeons use no dressings to cover the repaired lip; others advocate special bandages of collodion gauze, tape strips, or commercial adhesive bandage. The Logan bow, which has been in general use for many years, was once thought to relieve tension on the repair, an assumption which cannot be substantiated. The bow, nevertheless, does provide excellent protective device (not unlike the face guard on a football mask) for the infant who otherwise might bump his lip as he thrashes around in his crib. It is also an efficient apparatus for holding a swatch of fine mesh gauze over the lip wound. In our hospitals the gauze is moistened periodically with sterile saline and is changed three or four times daily by the nurses. As the moistened gauze dries, it keeps the wound edges free of blood and crusts. It is unnecessary for the nurses to swab the incision with moistened cotton applicators, and the only nursing requirement is that the gauze be changed regularly. With the bow used in this way, wound toilet can be accomplished with minimal trauma on the part of the nursing staff, who frequently may be inexperienced.

**Aftercare.** Following application of the dressing, the child is cared for in the immediate postoperative period by the anaesthesia team in the postanesthetic recovery room. The vital signs are monitored and the airway is kept clear by suctioning and by careful positioning of the head. It is imperative that observation be continuous until the child is completely alert. The child who has had a large lip defect repaired presents a particular hazard because prior to surgery he has never had to open his mouth in order to breathe. In the early postoperative period such a child must be encouraged actively to depress his chin and open his mouth, particularly if packing has been inserted in the nostrils.

It is essential that the small infant not be allowed to damage the surgeon's work. Numerous types of restraints, splints, and immobilizing gowns have been devised to prevent the patient from injuring himself. On rare occasions the rambunctious child may even require some sort of body restraint, but for the most part these children seem to do better if allowed a certain amount of freedom. Some sort of elbow splinting is essential to prevent the child from getting his hands to his lip. The most widely used elbow restraint is an easily laundered cloth wraparound sleeve with slots into which tongue blades are inserted. This device effectively maintains the elbow in extension, but care must be taken that it does not slip down below the elbow and hence become ineffective.

In the postoperative period the child is usually fed with a bulb syringe or a large medicine dropper for as long as three weeks. Boiled water may be given between formula feedings. For the larger child who is hungry, cereal and even mashed vegetables can be added

to the formula feedings and delivered through the same sort of syringe. There are some surgeons who, during the immediate postoperative period, permit the small infant to suck on a large nipple with large perforations. Although dehiscence of the lip wound is unlikely with this treatment, it is our opinion that every effort should be made to immobilize the lip to promote optimum healing.

It is always discouraging to see a symmetrical and otherwise attractive lip repair that has been marred by unsightly suture marks. When the muscle and subcutaneous sutures have been carefully applied, the fine skin stitches can be removed as early as the third postoperative day. Sutures at key points may be retained until the fourth or fifth day, but any stitch which appears to have elicited an inflammatory reaction or seems to be "cutting in" should be removed at once. Subsequent splinting with adhesive strips, collodion dressings, or adhesive bandages may be helpful. The authors continue to use the Logan bow for a period of eight or nine days following lip repair.

A word of caution: skin sutures that have been meticulously inserted should be removed just as carefully. Suture removal should be executed in a well-lighted room with the child's head firmly held by the attending nurse. Sedation may be necessary, and it may not be possible to remove all of the stitches at the same sitting. The unskilled removal of sutures can produce enough trauma to mar permanently an otherwise satisfactory result.

In many hospitals the mother is an integral part of the nursing team. She should be encouraged to visit her baby frequently, especially at mealtimes so that she can become thoroughly familiar with the techniques of dropper feedings. A bedside rocking chair can be a real convenience for the feeding ritual and for the soothing of an irritable baby.

**Extended Operations.** There is disagreement about what other corrections can be undertaken at the time of lip repair. What should be done with the nose? Can portions of the palate be repaired with the lip?

Many surgeons consider the nose a completely separate problem from the lip and decline to undertake definitive repair of the nasal tip at the time of initial surgery. Occasionally it is argued that, if ear cartilage can be cross-hatched and contoured with impunity in the preschool child, why cannot similar surgery be carried out on the alar cartilage of the infant. The objection to this reasoning is that the ear of the 4 or 5 year old child has achieved almost complete growth, while the alar cartilage of the newborn infant obviously has not. It is our opinion that the excision of a millimeter of alar cartilage in a 2 month old child may result in a 3 or 4 millimeter distortion by the time of puberty.

It must be emphasized that the infant's nasal cartilages are poorly developed at best, and in the cleft patient these structures may be attenuated. Attempts at surgical remodeling of the nasal tip should be undertaken with minimal disturbance to the cartilages themselves; certainly excisions or breaks of continuity of either the medial or lateral crus would seem unwarranted. The operation proposed by Berkeley (1959) appears to have worked well for certain surgeons. A promising and less radical technique for early correction of the nasal deformity has been described by Millard (1968) as an extension of his established rotation-advancement technique.

The authors warn that without adequate training and experience the surgeon would be ill-advised to undertake extensive operations on the ala at the time of primary lip repair. There are few things in the field of plastic surgery more distressing than trying to repair a nasal tip that is badly scarred, thickened, and deformed from overzealous early operations.

A number of surgeons undermine the affected alar cartilage through a lateral approach, separating it from the skin in an attempt to shift the cartilage during the primary lip repair. This procedure probably does little harm, provided the cartilage itself is not damaged and the work is carefully done. In some repairs the surgeon, while suturing the nostril floor, notes a disturbing buckling of the ala on the affected side. If this buckling cannot be corrected by simple undermining, it would seem wise to permit the condition to remain for secondary repair at a later date.

Just as it sometimes can be difficult to know where to stop in one's efforts to improve the nose, it can also be difficult to decide how much of the cleft should be closed at the time of initial surgery. Veau (1938), who more than anyone else stimulated modern technique in surgery for cleft lip and palate, devised a procedure in which the hard palate was repaired with a vomer flap at the time of primary lip surgery. Veau's operation was welcomed and used by many leading authorities. Ivy and Curtis (1934) combined it with the Blair-Brown cleft lip repair. Many other surgeons have advocated combined lip-hard palate repair, including Dorrance and Bransfield (1946), Waldron (1950), Dunn (1952), Marcks, Trevaskis, and da Costa (1953), Berkeley (1959), and Holdsworth (1963). Schmid (1955), Nordin and Johanson (1955), Schrudde and Stellmach (1959), and Schuchardt (1961) have repaired and, in addition, bone grafted the hard palate in combination with lip repair. Lip repair combined with soft tissue closure of the hard palate offers two advantages. First, one operation is eliminated. Second, the soft tissue closure of the hard palate is most easily executed through a wide-open lip, particularly in the alveolar area where oronasal fistulas can be especially annoying. To be weighed against these advantages is the greater blood loss and the increased risk of complication that any larger procedure theoretically entails.

While there are advocates of combined lip and hard palate repair, there are also those who decry such an operation. Among the opponents are Brown and McDowell (1948), Davis (1951), Slaughter and Pruzansky (1954), Trusler, Bauer, and Tondra (1955), May (1955), Wang (1960, 1962), Steffensen (1963), Millard (1963), Tennison (1963), and Musgrave (1963). Brown and McDowell (1948) stated: "It seems to us that good repair of the lip is difficult enough to require the surgeon's undivided attention". The inexperienced surgeon would do well to concentrate on the lip alone, deferring palate repair to a second sitting. Later, as he gains experience and confidence, each surgeon can decide for himself which of his patients, if any, are candidates for the combined operation.

It should be noted that Davies (1966, 1970) has perfected a technique for repair of the entire hard and soft palate, alveolar ridge, and lip in a single operation. This surgical tour de force is suited to complicating social and economic factors of medical practice in certain parts of the world where patients are difficult to follow and show no interest in staged procedures. In our opinion less radical surgery is preferable at this time.

Recently the work of Fára and coworkers (1965, 1971) has stimulated interest in dissection and reorientation of the fibers of the orbicularis oris at the time of lip repair. The intent is to construct an oral sphincter as nearly normal as possible so that symmetry of lip



movement can be obtained. The concept is appealing because it is widely observed that, with major clefts in particular, even the most successful repairs often do not maintain excellence of symmetry in all postures. Surely all experienced plastic surgeons at some time have been frustrated by the repaired lip that looks virtually normal in repose only to become tight and distorted on smiling, or by the repair that looks good on smiling and becomes redundant at rest. orbicularis oris dissection certainly represents an extension of the conventional approach to lip repair. Randall, Whitaker, and LaRossa (1974), who have had considerable experience with the technique, are encouraged by their results to date but point out that the long-term studies required for definitive assessment are not yet available.

## METHODS OF REPAIR

**Selection of Method.** During the past two decades there has been continuing improvement in the surgical reconstruction of cleft lips, particularly of the unilateral ones. Undoubtedly this progress has resulted from the development of better surgical techniques and the increasing availability of well-trained plastic surgeons. The goal of all repairs is a normal looking lip and a normal looking nose which will not be distorted by the effects of growth and aging. The normal look should be present in infancy and should persist through childhood, adolescence, and adulthood.

Steffensen in 1953 listed five criteria for satisfactory lip repair: 1. accurate skin, muscle, and mucous membrane union; 2. symmetrical nostril floors; 3. symmetrical vermilion border; 4. slight eversion of the lip; and 5. a minimal scar which by its contraction will not interfere with the accomplishment of the other stated requirements. One of the authors (Musgrave, 1963) has called attention to two additional criteria which can properly be added to this list: 6. preservation of the Cupid's bow and the vermilion-cutaneous ridge; and 7. production of symmetrical nostrils as well as symmetrical nostril floors. It is important at the time of repair that the surgeon recognize established growth patterns which may subsequently alter the configuration of the lip. This recognition is of particular importance in the planning of certain triangular and rectangular flap repairs, in which an early excellent result can be marred by distressing lengthening prior to puberty. Growth problems of a somewhat different sort can result when excessive, meddlesome alar cartilage surgery at the time of primary lip repair produces a stunting of nasal tip growth. Aufrecht (1960) has made a particular point of avoiding damage of the alar cartilage by temporarily accepting nostril contour irregularities in the small infant. The authors agree that one should not compromise the chances for a long-term good result by being overzealous with nostril and alar cartilage surgery in infancy.

In time many surgeons develop a preference for one method of lip repair. Unfortunately this preference can lead to a rigidity of thought in which all lip defects are made to fit a favorite operation without concern that another operation might better fit a particular lip defect. Just as the well-trained and experienced general surgeon does not use the same operation for all inguinal hernia repairs or for all gastrectomies, the plastic surgeon should not select a technique of lip repair without considering the deformity and the tissues available. Even though it is agreed that any one method of lip repair described in this chapter can be used to close any unilateral cleft, it nevertheless does seem that certain operations are better suited for certain variations of the defect than for others. The plastic surgeon should never be guilty of explaining his choice of repair with the statement, "It may not be the most suitable operation, but it is the one I know how to do".

As a general rule the method of lip repair should be selected which discards an absolute minimum of tissue (in many instances the surgeon has the distinct impression that he already is dealing with a paucity of tissue). A strong plea should be made for preservation of the Cupid's bow. Since there are currently a large number of techniques to choose from, no procedure should be considered a method of choice if it distorts or discards the Cupid's bow.

In the very minor unilateral cleft lip deformity, there is a grooving in the upper lip with a depression of the skin and a lack of continuity of lateral and medial muscle mass. The nostril may be slightly transverse in position, but the floor is intact. There is notching upward from the vermilion-cutaneous ridge, with an apparent deficiency of vermilion and mucous membrane. Because there is only minimal foreshortening of the medial segment, the central portion of the Cupid's bow is tilted only slightly from the normal transverse position. For such minor degrees of cleft it would seem to be an unnecessary and unwarranted intrusion to insert some form of triangular or quadrilateral flap into the adjacent philtrum. In these cases the modified Rose-Thompson repair can be a most satisfactory operation. The scar lies along the lateral margin of the philtrum in a natural line. Even though the scar under the conditions of the repair will show a minimal tendency to develop contracture, it is advisable to incorporate a Z-plasty in the mucosal closure. The Rose-Thompson or some other modification of the straight line repair should not be used if the cleft is wide or if the surgeon finds, on making his initial markings, that large amounts of medial tissue will be discarded and the Cupid's bow thereby eliminated.

In examining the many operative techniques devised for the repair of the unilateral cleft lip, one is struck by the fact that the early surgeons were willing to introduce medial tissues laterally as well as lateral tissue medially. Over the years the latter approach has gained favor at the expense of the former, so that the introduction of lateral tissue medially has become a feature of most currently used lip repairs. The introduction of tissue low in the medial portion of the lip, which was the basis for the Blair-Brown-McDowell repair, has the advantage of producing an early outward pouting of the lip just at the vermilion-cutaneous ridge.

The principle of Z-plasty has been used widely in the field of plastic and reconstructive surgery. In essence the various repairs which utilize rectangular and triangular flaps transpose or interpose small pedicles to create a Z-scar. A zigzag scar avoids a tight, contracting line extending from the nostril floor to the free margin of the lip, a particular source of trouble when straight line repairs are employed for major clefts.

In the design of a small rectangular or triangular flap for introduction low into the prolabium, there is left unused some lateral tissue in the upper portion of the lip. If this lateral tissue is salvaged as a small pedicle and then is turned upward and medially, further support can be given to the nostril floor, a principle employed in the Collis procedure. In essence, the Skoog procedure (1958) represents a combination of a small superior flap with a low triangular flap. The Trauner operation (1967) is similar except that the upper flap is larger.

If a high lateral flap to be turned medially is introduced not into the floor of the nostril but into the lip just below the base of the columella, the result is a shoring up of the nostril floor and a lengthening of the short medial segment. While both the Millard and Wynn operations are based upon this concept and produce lip scars that are somewhat similar, the

two operations are executed quite differently. In the Millard operation the short medial portion of the lip is lengthened, and the Cupid's bow is brought into proper position by rotation inferiorly. The resulting defect is filled by advancement of a lateral flap superiorly to maintain the correction. Hence, Millard calls his operation the rotation-advancement procedure. In the Wynn operation, the medial rotation is similar to that of Millard, but the lateral flap introduced is a superiorly based interpolated one which, in the process of repair, is rotated from a vertical to a transverse axis. Although Wynn calls his operation the lateral flap technique, it might well be thought of as a rotation-rotation procedure. The Trauner operation in its upper half resembles the Wynn procedure, and in its lower half the triangular flap operation described by Tennison and modified by Randall, Hagerty, Brauer and Cronin.

Millard, since he first presented his rotation-advancement operation in 1955 at the First Congress of the International Society of Plastic Surgeons in Stockholm, has continued to amplify his design to the point that a second distinct, though related, operation has been evolved. Following Millard's presentation of his extended operation in 1967 at the Fourth International Congress of Plastic and Reconstructive Surgery in Rome, the senior author labeled the newer technique the Millard II procedure. The original or Millard I operation has always been an excellent repair for the more minor clefts. In the Millard II operation corrections have been added which make the results of the rotation-advancement principle more pleasing in extensive cleft deformities. In the newer operation that portion of the medial segment formerly rotated laterally to reinforce the nostril sill is used to lengthen the columella, and the incision used to permit downward rotation of the Cupid's bow is made more effective by the use of a "back cut". Because the Millard II technique requires that the entire reconstruction of the nostril floor be done with the advanced lateral flap, extensive incisions around the alar inset may be required. A complete nasal tip correction is an option which the surgeon may incorporate into the primary repair (in addition to the columellar lengthening), or he may defer it to a later stage. There is no doubt that the Millard II technique has increased the usefulness of the rotation-advancement principle.

**Appraisal of the Various Techniques of Repair.** Any of the methods presented in this chapter can be used to repair any unilateral cleft. However, it is important to remember that, with the triangular and rectangular flap repairs, the "die is cast" at the initial operation. The surgeon undertaking a major revision at a secondary operation will find that, even after taking down the entire lip, he will be able to make only minor changes that will be likely to leave him still dissatisfied with the final result. Perhaps the surgeon at the time of the initial repair should not be planning ahead for lip revision, since in theory, if he does his job well at the first operation, subsequent procedures will be unnecessary. However, all primary repairs do not yield perfect results, and the surgeon should therefore realize that revision of any of the straight line and rotation-advancement repairs is much simpler than revision of a rectangular or triangular flap repair.

For the sake of completeness, most of the best known methods of lip repair are illustrated in this chapter. Although the use of eponyms is obviously undesirable, the operations described will be given the names of the surgeons credited with their original design. Most of the repairs are so complicated in their detailed geometry that no concise purely descriptive nomenclature is possible. The terminology used is believed to be standard, and despite theoretical drawbacks it has the advantage of being understood by plastic surgeons throughout the world.

On the service of the authors, the Mirault-Brown-McDowell operation is no longer performed. The straight line Rose-Thompson repair is still used for minimal degrees of cleft lip. The rectangular flap of LeMesurier is not used because it does not preserve the natural Cupid's bow; however, on rare occasions the Wang (1960) modification of the rectangular flap procedure is still used for wide clefts. The Randall modification of the triangular flap technique remains a standard operation, but it is used with less frequency. On out service and around the world, the rotation-advancement principle of Millard has gained steadily in popularity. The advantages of the operation are many and the disadvantages few.

At times it may be difficult for the surgeon to decide which operation is best for his patient. He should analyze the defect and, bearing in mind the previously discussed criteria of a satisfactory repair, should select the technique which in principle will correct the defect at hand. The number of techniques to choose from is modest, although the number of variations available may seem overwhelming. Straight line repairs are suitable for only the most minor clefts; in all other cases some sort of flap repair is necessary. The surgeon must never forget the cardinal rules: *discard as little tissue as possible* and *preserve the Cupid's bow*.

## **TECHNIQUE OF THE VARIOUS REPAIRS**

### **1. Randall-Graham Lip Adhesion**

A. Markings for the definitive lip repair are made to assure that dissection for the adhesion operation does not damage tissue required for subsequent surgery, particularly tissue of the Cupid's bow (vermilion-cutaneous ridge).

B. Two rectangular flaps are elevated and interdigitated. If necessary to avoid tension, the lateral lip segment and adjacent cheek can be mobilized through a labial sulcus incision.

C. A three-layered closure is accomplished.

D. Surface suturing completes the operation.

Advantages of Lip Adhesion. When the surgeon foresees that lip repair will be difficult, he should consider a preliminary adhesion operation. The adhesion can prove valuable (a) by molding underlying distortions of the maxilla and premaxilla and (b) by possibly stretching out attenuated and displaced adjacent soft tissues.

Disadvantages of Lip Adhesion. There probably are no disadvantages of great significance. The operation is not routinely necessary. The resulting scar may be a nuisance in a creative sight method of repair, such as the Millard II, in which the surgeon customarily finds a use for almost every fragment of tissue. In selected cases the disadvantages are trivial compared to the possible gains lip adhesion can bring.

### **2. Rose-Thompson Straight Line Repair.**

A. In all cleft repairs, markings of the intact and cleft nostril floors serve as important landmarks. These markings, which are temporary tattoos made with a fine hypodermic needle dipped in methylene blue, are made on the basis of sight judgment without the help of

measurements. Marking the nostril floors is made easier if the noticeably displaced columella is pushed toward the midline.

B. The height of the intact side of the lip from the nostril floor to the peak of the Cupid's bow is measured with calipers. It is wise to check the markings from the front view (with the surgeon standing at the patient's side) and from the head of the table (with the surgeon looking down toward the foot). Markings which seem to be satisfactory from one vantage point may appear totally unsuitable from the other.

C. A V-excision (dotted line) usually discards an excessive amount of tissue. Curving the incisions increases the height of the lip and at the same time salvages more vermilion and produces an outward thrust or pout of the reconstructed lip.

D. In addition to the markings in the nostril floors, double dots of dye are introduced at the vermilion-cutaneous ridge to aid in alignment of this important structure during suture repair.

E. After all markings have been made, the lip is infiltrated with lidocaine or procaine, 1/2 per cent, containing epinephrine 1:100,000 or 1:200,000. Infiltration of the solution is useful in obtaining hemostasis and gives a firmness to the lip which facilitates the making of a precise incision. Note that the endotracheal tube has been carefully taped in the midportion of the lower lip so that there is no distortion on either side.

F. All skin incisions are made through the dermis with a No. 15 blade. A No. 11 blade can be introduced to divide the muscle and mucous membrane. The No. 11 blade is too thin and flexible to be satisfactory for the making of precise skin incisions.

G. The muscle layer is repaired with fine sutures accurately placed and not snugly tied.

H. Well-placed buried sutures remove tension from the skin sutures, which should be of fine material, such as 6-0 silk or nylon. Because the skin sutures are not under tension, they can be removed on the third day to minimize the chances of stitch marking.

I. A Z-plasty should be performed on the undersurface of the lip to deter contracture of the straight line scar during the healing process.

J. Straight line lip scars have been criticized for their tendency to contract. The cross-sectional diagram shows a scar line which begins at point A and goes around the fullness of the mucous membrane to end at point B. In all other lip repairs, somewhere between A and B there is a modified Z-plasty (in the Millard operation at point I, in the Tennison and LeMesurier operations at point II). Consequently, a Z-plasty should be introduced into the Rose-Thompson procedure at or near point III.

Advantages of Straight Line Repair. (1) The resulting scar lies in a satisfactory direction. (2) The operation is uncomplicated by small flaps and therefore is easier to execute. (3) Measurements can be made with precision, with little concern for the possible future disproportionate growth that can be a real problem where vertical flaps are turned into horizontal positions.

Disadvantages of Straight Line Repair. The straight line methods sacrifice large amounts of tissue which cannot be spared in major clefts without the creation of noticeable microstomia and destruction of the Cupid's bow. For this reason the straight line methods should be reserved for only the most minor degrees of incomplete cleft.

### **3. Mirault-Brown-McDowell Repair.**

A. According to Brown and McDowell (1950), the main problem in unilateral cleft lip is a triangular deficiency on the medial side (black triangle). The deficient area is filled by transferring a triangular flap from the lateral side of the cleft.

B. The base of the columella is pushed toward the midline, and a mark is made at the mucocutaneous junction on a level with the flared base of the columella.

C. Lines A"C and A'C' are marked to equal AD, the height of the lip of the normal side. These lines extend from the floor of the nostril (A"A') to the vermilion-cutaneous border. Point C frequently will fall on the opposite side of the Cupid's bow depression.

D. A triangle is established on the lateral side by drawing B'C" (equal in length to B'C'). B'C' is only marked, not incised. The normal lip in profile pouts forward just above the vermilion border. This "break" occurs about two-thirds or three-quarters of the way down the lip. Reproduction of the "kick out" of the vermilion and the skin just above it is a desired goal of the repair.

E. The shaded area is excised. One of the strongest criticism of this method is its disregard of the Cupid's bow. Brown and McDowell, however, feel the importance of the Cupid's bow has been overestimated.

F. Brown and McDowell point out that adequate mobilization of the ala and cheek is necessary. Separation of the alar cartilage from the overlying skin is carefully done prior to suture of the lip.

G. Layered repair is accomplished as discussed elsewhere in the chapter.

H. The resulting line of repair is a zigzag one which helps to offset any tendency to scar contracture.

Advantages of the Mirault-Brown-McDowell Operation. (1) The technique conserves lateral vermilion. (2) It introduces lateral lip tissue into the deficient medial portion of the lip. (3) It produces a forward pout of the lip. (4) It is an easy method to teach, and even the inexperienced surgeon should not end up designing or cutting a flap in the wrong direction.

Disadvantages of the Mirault-Brown-McDowell Operation. (1) The technique discards excessive tissue from the medial side of the lip. (2) The curved scar which extends to the inferior midportion of the lip lies in an unattractive position. (3) The Cupid's bow is ignored. (4) The lip repaired by this method may have a tendency to become tight as the patients grows older, and, for some unexplained reason, the vermilion may become quite thin.

### **4. LeMesurier Rectangular Flap Repair.**

A. Points in the floor of the nostril are marked as described for earlier methods. All measurements should be made prior to the injection of local anesthetic solution.

B. Measurements are made with calipers. The major vertical distance (A'C') and minor vertical distance (B"D") equal the total vertical distance (AB).

C. The lateral flap is planned. The minor vertical distance (at right angles to the vermilion border) should be slightly less than one-third the total lip length. Thus, if AB is 12 mm (a frequent finding), the minor vertical distance would be about 4 mm and the major vertical distance 12 minus 4 or 8 mm. In illustrations by Steffensen, Brauer, Trusler, LeMesurier, and Wang, the 2/3:1/3 ratio is evident. A"C" is roughly parallel to the vermilion border but is *closer* than in the Tennison repair. C" is usually closer to the edge than B".

D. In the LeMesurier repair, the degree of rotation of the quadrilateral flap influences the height of the vermilion-cutaneous ridge. Too much or too little rotation causes asymmetry of the Cupid's bow. In all planning one should be conservative; thus, if the intact lip measures 13 mm, plan to construct a lip only 11 or 12 mm in height. It is better to have the lip on the repaired side one or two millimeters shorter than on the normal side because of the possibility of future disproportionate growth.

E. The medial incision is planned. Downward rotation of the quadrilateral flap is maintained by flap X. The angle of flap X should therefore be adjusted to produce the amount of rotation desired. Line A'C' is usually straight, but it may be made slightly convex to gain length.

F. The cheek and alar cartilages are mobilized as in the Mirault-Brown-McDowell repair.

G. Skin incisions are made with the No. 15 blade and are deepened through muscle and mucous membrane with a No. 11 blade. It is wise to measure and remeasure prior to incising.

H. A small portion of flap A"B"D" is rotated upward to aid in forming the floor of the nostril. The medial lip is pared from A' to C', but a perpendicular incision is not made until the upper portion of the lip has been sutured. The angle and the length of B'C' thus can still be altered.

I. Suturing starts in the floor of the nostril. After the first suture is in place, the nostril floor is viewed from above and below. If the appearance of the nostril floor is not completely satisfactory, the suture is removed and replaced.

J. If the vermilion is thin on the lateral side, some fullness of the medial flap can be introduced. This step is usually unnecessary, and in most cases the vermilion flaps are cut vertically as shown.

Advantages of the Rectangular Flap. (1) The technique produces a natural fullness at the vermilion-cutaneous ridge. (2) The markings, though complicated, are still somewhat easier to calculate than those employed for a triangular flap because there is no need to make an allowance for the hypotenuse of a triangle. (3) The operation conserves lateral vermilion,

a particularly desirable feature in wide clefts. (4) Although the original operation of LeMesurier reconstructed rather than preserved the Cupid's bow, the Wang modification preserves the natural peak on the cleft side.

Disadvantages of the Rectangular Flap. (1) The scar, like that of the triangular flap, breaks up the philtrum. (2) There is a tendency for disproportionate growth to occur, so that the repaired side becomes asymmetrically long. For this reason it is wise to plan the repair to be 1 mm short with the expectation that the lip will become symmetrical by the time the child starts school. (3) Lips repaired by this technique are difficult to revise.

## **5. Triangular Flap Repair.**

A. In the original Tennison method, the flap was marked out with a wire divided into three equal parts and bent into a Z (stencil) after calipers had been used to measure the height of the normal side of the lip.

B. On the medial side, the upper angle of the bent wire was placed parallel to the vermilion border and the middle arm of the Z approximately perpendicular to the vermilion border. The lower arm of the Z was not used. (Brauer and others have designed line BC so that it forms an obtuse angle with line AB.)

C. Brauer (1959) warned that in planning a Tennison repair none of the points chosen on the lateral side should fall lateral to a vertical line dropped from the inset of the ala to the vermilion, or distortion may occur.

D. The vermilion is incised vertically without interdigitating flaps. The lip is repaired in layers.

E. Hagerty (1958), in order to make the triangular method more scientific, introduced new measurements.  $AB \text{ minus } A'B' \text{ equals } X$ .

F.  $X$  equals the distance the apex of the Cupid's bow must be lowered on the medial side ( $X'$ ).  $X$  also equals the base ( $X''$ ) of the triangular flap to be introduced from the lateral side.

G. A line is marked from the base of the columella to the midpoint of the Cupid's bow. The line is crossed by a perpendicular passing through the apex of the Cupid's bow ( $B'$ ). Point  $Y$  is marked halfway between the intersection of these two lines and the midpoint of the Cupid's bow. Incision  $YB'$  permits introduction of a lateral isosceles triangle with the base  $X''$ .

H. Randall's modification is designed to ensure equal height on the normal and repaired sides. Thus, distance 4-2 (on the normal or intact side) equals 5-3 equals 6-8. Selection of points 4, 5, and 6 is as in other methods where these points are A, A', and A''. Point 3 is at the height of the Cupid's bow, a fairly standard marking for triangular lip repairs. Point 7 is near the midline of the philtrum and should never extend beyond line 4-2. Line 3-7 is approximately at right angles to the vermilion-cutaneous ridge.



I. Points 10 and 11 are located approximately at the midpoint of the transverse incisions. Dotted lines 5-10 and 11-8 determine the height on the cleft side. These measurements are actually determined before any incision is made, and they can be checked after the medial incisions have been completed but before the lateral incisions are made.

J. Point 8 is made where the vermilion-cutaneous ridge begins to disappear. Point 9 can be moved forward or away from point 8 to obtain the desired distance between 8 and 11 (the minor vertical dimension). The desired distance is calculated by subtracting 5-10 from 2-4, as shown.

Advantages of the Triangular Flap. (1) The natural Cupid's bow is preserved. (2) The flaps is introduced in such a way as to produce fullness near the vermilion-cutaneous ridge. (3) Minimal tissue is wasted. Almost no tissue is discarded medially, and only a small amount of tissue high in the lip near the nostril base is discarded laterally. The method is therefore of particular value in wide clefts in which tissue deficiencies are most severe.

Disadvantages of the Triangular Flap. (1) The scar intrudes upon the philtrum and at times may be fairly noticeable despite the most meticulous surgical technique. (2) There is a tendency to disproportionate growth, especially if the triangular flap employed is a large one. As with the rectangular flap, the surgeon should design his repair to be somewhat short with the expectation that lengthening will occur. A triangular flap repair which becomes excessively long with growth is extremely difficult to shorten.

## **6. Millard I Rotation-Advancement Repair.**

A. The method is a sight one. The normal is not measured as in other techniques. The depth and the height of the Cupid's bow are marked. Calipers may help in locating the peak of the bow on the cleft side if it is indistinct.

B. After the Cupid's bow has been marked, traction is placed on the tubercle with a skin hook, and the proposed incisions are outlined. The vermilion-cutaneous ridge is marked with double blue dots. A local anesthetic and epinephrine solution can be injected if care is taken to avoid distortion.

C. The incision is made along line AB as traction is maintained on the tubercle. The incision is continued until the Cupid's bow is rotated downward into the normal position. The upper end of the incision may extend beyond the midline, but it should not extend beyond the philtral pillar on the normal side, or the normal side of the lip will be lengthened by the repair.

D. A lateral flap is made so that CD equals AB. In wide clefts it may be necessary to move point D closer to the oral commissure than the diagram indicates. Advancement of the lateral flap rotates the ala into position. Occasionally it may be necessary to discard a small triangle in the nostril floor (shaded area).

E. Flap X, which lies between incision AB and the freshened margins of the cleft, is turned into position to form the sill of the nostril. The flap helps to pull the columella and membranous septum into position.

F. The longitudinal incision AB follows and imitates the natural line of a philtral column. The Z-plasty in the upper portion of the lip is hidden in shadow and in the crease lines of the nostril floor.

G. Most of the tension in this repair occurs high in the lip where it is normally tight. As one proceeds in this operation, the medial side can be lengthened as necessary by extending the incision beneath the columella further toward the intact side or by curving it inferiorly in a slight hook. The lateral flap can be lengthened by carrying incision CD further toward the oral commissure.

H. In severe complete clefts it may be difficult by Millard's original technique to unfurl the Cupid's bow (i.e., rotate the Cupid's bow inferiorly) unless incision AB is extended considerably past the columellar base on the intact side. The problem can be solved by the more recently described "back cut". It may also be difficult to devise a lateral flap sufficiently large to fill the defect created by rotation of the medial segment. It may be necessary to use thin and only barely satisfactory tissue for the tip of flap Y, and it may be necessary to carry the incision along the inferior margin of flap Y far down along the vermilion-cutaneous ridge toward the oral commissure. The possibility that it may be necessary to sacrifice disproportionately large amounts of lateral vermilion, leading to a narrowing of the upper lip on the cleft side, is the most serious shortcomings of the rotation-advancement principle.

Advantages of the Millard I Rotation-Advancement Operation. (1) The method is a highly flexible sight one which permits constant modification throughout the course of operation. It is the most satisfactory operation yet devised for the mild to moderate degrees of cleft. The surgeon is never faced with a point of no return as he is in the rectangular and triangular flap methods, in which once the initial markings and incisions have been made, little can be done to influence the outcome of the operation. (2) The margins of the flaps follow natural lines (the philtral pillar and the nostril sill) and preserve not only the Cupid's bow but also the philtral dimple. The scars of the repair, like those of the Rose-Thompson method, lie in ideal locations for camouflage. (3) A pleasing outward pout of the lower portion of the lip is preserved in the reconstruction. (4) The inherent flexibility of the design lends itself to secondary revisions. (5) Disproportionate growth is rarely a problem. The surgeon can expect that the length of the repaired side relative to the length of the normal side obtained at the operating table will be maintained throughout life. The exceptions to this generalization are extraordinarily few. During the early weeks of convalescence, while the scars are erythematous and indurated, shortening of the repaired lip usually is observed, but this discrepancy becomes self-correcting as maturation occurs.

Disadvantages of the Millard I Rotation-Advancement Operation. The only significant shortcoming is the difficulty that can be expected in design of an adequate lateral flap in wide complete clefts. In order to obtain a suitable flap, it may be necessary to sacrifice too much lateral vermilion, thereby causing noticeable asymmetry of the Cupid's bow.

## **7. Millard II Rotation-Advancement Repair.**

A. As in other techniques which preserve the Cupid's bow, the height of the bow on the normal side (1) and the depth of the bow in the midline (2) are marked. Point 3 is marked on the margin of the cleft so that line 2-3 equals line 2-1. Point 3 becomes the height of the Cupid's bow on the repaired side. An incision is made upward from point 3 in such a way

that it skirts the philtral dimple and curves under the columellar base to point 5 lying between the midline and the philtral pillar on the normal side. Point 5 has a variable location, depending upon the amount of rotation required to bring the Cupid's bow (line 1-2-3) into normal position. If a great deal of rotation is required, line 3-5 can be extended with a "back out" to point x, which must lie medial to the normal philtral pillar. The exact position of point x is also variable and depends upon the amount of rotation required. The incisions for the lateral advancement flap are shown curving around the alar inset superiorly and paring the cleft edge from point 6 to 7 medially and inferiorly. The distance from point 6 to point 7 must equal the distance from point 3 to x. The shaded areas indicate the likely discard of vermilion.

B. The Cupid's bow has been rotated inferiorly into normal position. A hook in the apex of the cleft nostril is used to pull flap C into position and thus lengthen the columella on the cleft side. Moderate undermining of flap C is usually required for the repositioning.

C. Points 9 and x are approximated, and flap C is sutured into place.

D. The lateral lip and the alar inset are freed generously from the maxilla through an incision which extends from the superior labial sulcus along the pyriform aperture to the midline. In an optional and unillustrated extension of the operation, the nasal cartilage and nasal lining can be mobilized with the help of a rim incision which produces a flap of these structures based on the nasal septum. The displaced alar dome on the cleft side can be repositioned and anchored to the normal dome with a nonabsorbable suture. The optional nasal cartilage correction can be accomplished at a later operation instead of at the time of primary repair if the surgeon prefers.

E. Point 6 is advanced to point x by one of the key sutures of the repair.

F. Margins x-3 of the medial segment and 6-7 of the lateral flap are not automatically congruent. They must be trimmed to fit one another in such a way that the corrected position of point 3 is undisturbed. A tiny interdigitation flap of vermilion-cutaneous line can be constructed at point 7 to break up the scar as it crosses the Cupid's bow.

G. The nostril floor is repaired, and the operation is complete. The distance between points 4 and 1 should equal that between points 8 and 7.

Advantages of the Millard II Rotation-Advancement Operation. The Millard II operation has all the advantages of the Millard I and, in addition, provides for lengthening of the columella on the cleft side and better correction of the alar flare. Repositioning of the alar dome is an available option.

The Millard II operation, like its predecessor, is extremely flexible. The published design need not be rigidly followed; indeed, many surgeons who employ Millard's principles regularly find they seldom perform precisely the same operation twice.

Disadvantages of the Millard II Rotation-Advancement Operation. The Millard II operation has the same shortcoming present in the Millard I, only to somewhat more extreme degree. Medial tissue employed in the Millard I operation to reconstruct the nasal sill is used to lengthen the columella in the Millard II procedure. Therefore, additional demands are made

upon the lateral lip flap. The surgeon may consequently have even more difficulty with the design of an adequate advancement flap which does not noticeably foreshorten the distance of the oral commissure on the cleft side from the ipsilateral apex of the Cupid's bow.