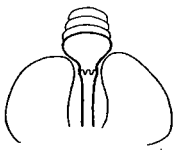
2. *Bilateral Cleft Anatomy*

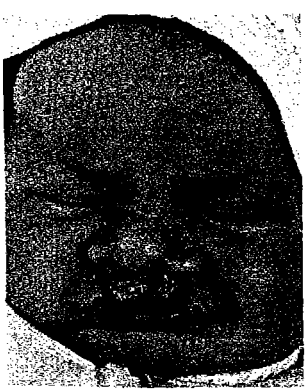


IN a single cleft, the premaxilla is normally attached to the maxilla on one side and this entire component is rotated outward varying degrees from the cleft side maxilla in an asymmetrical distortion. Double clefts present an entirely different configuration. In the complete bilateral cleft the premaxilla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

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

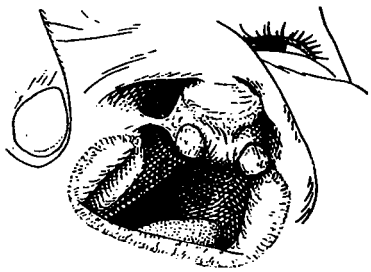
Where the cleft is incomplete on both sides, the deformity is less and is still symmetrical. In such a case there is usually a more or less intact alveolus and little or no protrusion of the premaxilla. The columella is likely to be longer than in the complete cleft but not of normal length.

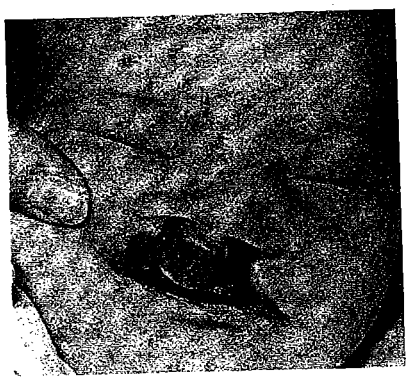
Sometimes the degree of cleft varies on each side. Sometimes the incompleteness shows as only the slightest notch on one side



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

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





SIMONART'S BAND

While at Rooksdown House, Basingstoke, England in 1948–1949, I learned to refer to residual congenital skin bridges spanning the upper portion of lip clefts as Simonart's bands. Holdsworth later referred to them as Simonartz bands. In recent years a search has been underway to discover the origin of this mysterious sobriquet. In 1976 Tom Gibson, intrigued by these terms, found that Gustav Simon in his 1868 book had presented an adhesion-type operation for bilateral clefts (Chapter 13) and deduced that someone subsequently must have written about repositioning of the premaxilla by creating the transverse bands of "Simon Arzt in Rostock." This would be an operative band, not a congenital one. Meanwhile I turned to S. Anthony Wolfe and he turned to Sam Pruzansky who forwarded two lead references. Simonart: "Note sur les Amputations Spontanées," *Journal*

as Arzt means doctor in germen

des Connaissances médicales, June 1846, pp. 327–330, also *Archives Medicales Belges,* 1846, pp. 112–119. With these references Tony Wolfe wrote Richard J. Wolfe, Rare Books Librarian, Francis A. Countway Library of Medicine, Harvard Medical School, who sent photocopies of the first Simonart article. Then Tony Wolfe wrote his friend Michael Meesen, Liège, for information on Simonart and received a notice obtained from a Belgian registry which indicated there was a man named Pierre-Joseph Cécilien Simonart, professor agrégé at the University of Brussels, born in Wavre, May 20, 1816, died Wavre, December 19, 1846, age 30.

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

> Chez un fetus recueilli, il y a peu de temps, a la Maternité de Bruxelles, la joue de chaque côté, a partir de la commissure labiale, est comme coupée dans toute son épaisseur par une bride de cette espèce, qui remonte vers l'occiput.
> In a fetus obtained not long ago at the Maternite of Brussels, the cheek on each side, from the labial commissure, was cut in all its thickness by a band of this type which extended up to the occiput.

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

> Les parties molles souscutanées sont déja separées et quasi coupées, que la peau reste encore intacte: celle-ci n'a subi qu'un léger amincissement.
> The subcutaneous soft tissues are already separated and almost divided with the skin remaining intact: it has undergone only a slight thinning.

Thus it seems that as Simonart did indeed refer to congenital skin bridges in the area from the labial commissure and cheek to the occiput, over the years the name Simonart's bands somehow became associated with residual skin bridges crossing the upper portion of lip clefts.

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

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

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

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

Prolabium

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

Muscle discrepancy

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

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

It is interesting how "mod" Thomas Rees, son of a Mormon professor of biology at the University of Utah, got interested in the muscle of the prolabium. About 1955, while training with McIndoe at East Grinstead, Rees operated on a 15-year-old Irish boy with a complete bilateral cleft. The prolabium was so attenuated that he used it for columella, noting its absence of muscle. The following year McIndoe took Rees with him to his great wheat farm on the northern slope of Kilimanjaro, East Africa, and during this trip McIndoe, Rees and Michael Wood started a

Thomas Rees

plan that was later to develop into the Flying Doctors of East Africa. During other trips to Africa, Rees operated on two other adult bilateral clefts with attenuated prolabiums. As he wrote recently,

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

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

Histological picture

In 1967 Fara and Smahel made some deductions from the study of 330 cases of complete bilateral cleft lips operated on in recent years. Only 3 percent of the bilateral cases were clefts just of the lip and alveolus, and none were clefts of the lip alone. Their microscopic sections of the prolabium of stillborns and children five to seven months of age revealed concurrence in Veau's original assertion that the prolabium suffers from muscular "sterility." They noted

> no striated muscle fibers whether differentiated or in various stages of differentiation.

Wayne Slaughter

this is a first.

Orbicularis oris muscle fiber direction

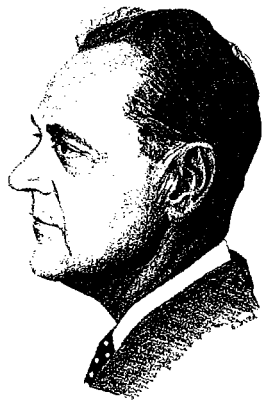
In 1960 Wayne B. Slaughter, J. W. Henry and J. C. Berger of Loyola University, Chicago, noted that the muscular components in clefts do one of several things:

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

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

As early as 1965, Fara and Hrivnakova mentioned that the orbicularis oris muscle fibers parallel the cleft edges in incomplete

clefts. By 1967, along with reemphasizing the lack of striated muscle in the prolabium, Fara and Smahel noted immature, fine, collagenous, connective, felt-like tissue and a rich vascular network. In the lateral lip segments they found:

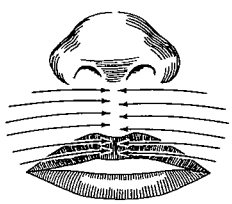


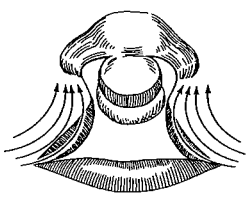
Miroslav Fara

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

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

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





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

Muscle anatomy in bilateral clefts

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

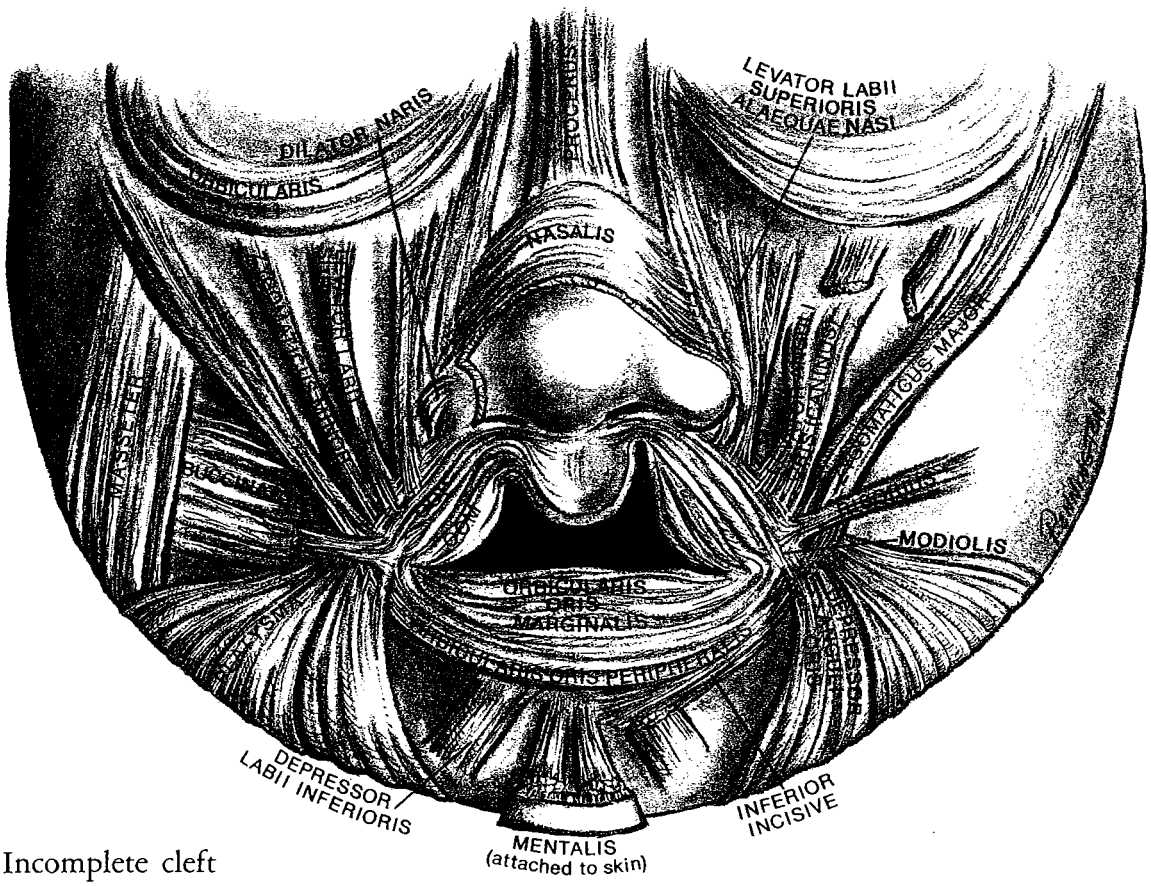
In incomplete bilateral clefts the orbicularis oris muscle fibers run parallel to the lateral lip edges but manage to sneak some fibers through the skin bridges which then fan out into the prolabium. With smiling and crying the lateral lip elements are partially restrained by the bridges, and the prolabium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

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

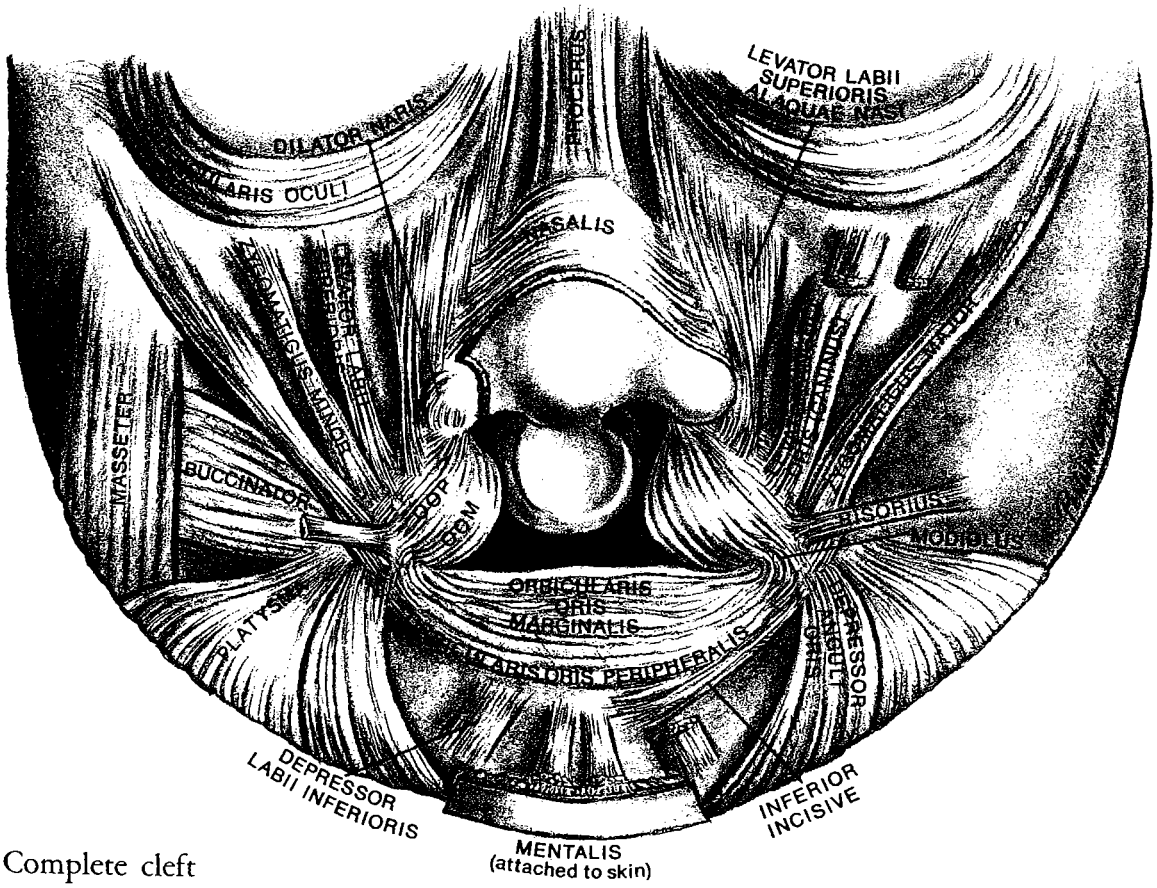
In complete bilateral clefts the orbicularis oris muscle fibers in the lateral lip elements run parallel to the cleft edges toward the alar bases. The prolabium itself has absolutely no muscle. During expression of emotion by laughing and crying, while the lateral lip elements are jerked without restraint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

Sensory nerves

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



Incomplete cleft



Complete cleft

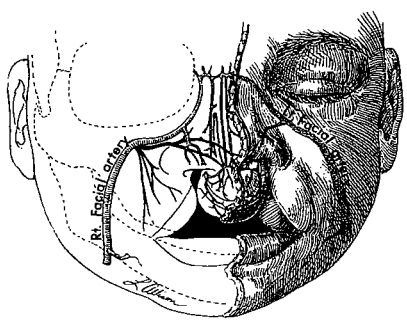
down dividing into a medial division to the septum and a lateral division to the fossa anterior to the nasal concha, the upper part of the medial tubercle and the frenulum. The infraorbital nerves, besides splaying out to supply the cheek, give off two large trunks which cross the face to the side of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

Motor nerves

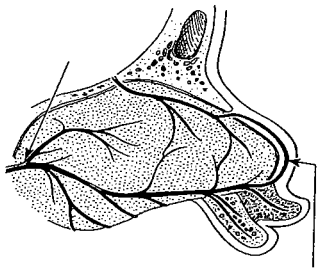
The branches of the facial nerve follow the distribution of the muscles but do not spread quite so far. As they approach from the sides, they are not affected by the cleft, except of course they do not cross the complete cleft. There is no muscle to serve in the totally isolated prolabium anyway. In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

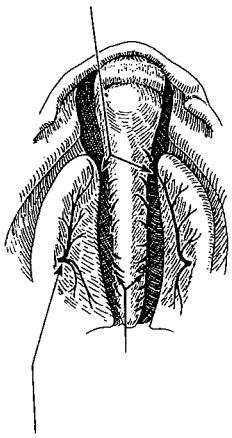
Vascular patterns in bilateral clefts

In the bilateral cleft specimens studied by Summerfield King in 1954, the right facial artery gave a descending branch to the ala and another branch to the dorsum of the nose but took no part in the supply to the medial tubercle. The left artery formed a horizontal arch which crossed the lower part of the nasal bone and then split as it reached the midline into two divisions that passed down the dorsum of the nose side by side to the philtrum region. Here each division gave a branch that wound over the body of the premaxilla to reach the shallow alveolus of the lateral incisors and entered the pulp. The two divisions then passed along the attachment of the frenulum and ended supplying the medial incisor teeth. They finally anastomosed with the sphenopalatine artery. The veins accompanying the arterial trunks were plexiform in arrangement with intercommunications.



Wayne B. Slaughter with pathologist James W. Henry and Jack C. Berger in 1960 in *Plastic and Reconstructive Surgery* compared the vascular patterns of normal people with those of four human specimens with clefts and serial microscopic sections from 20 cleft infants. They noted:





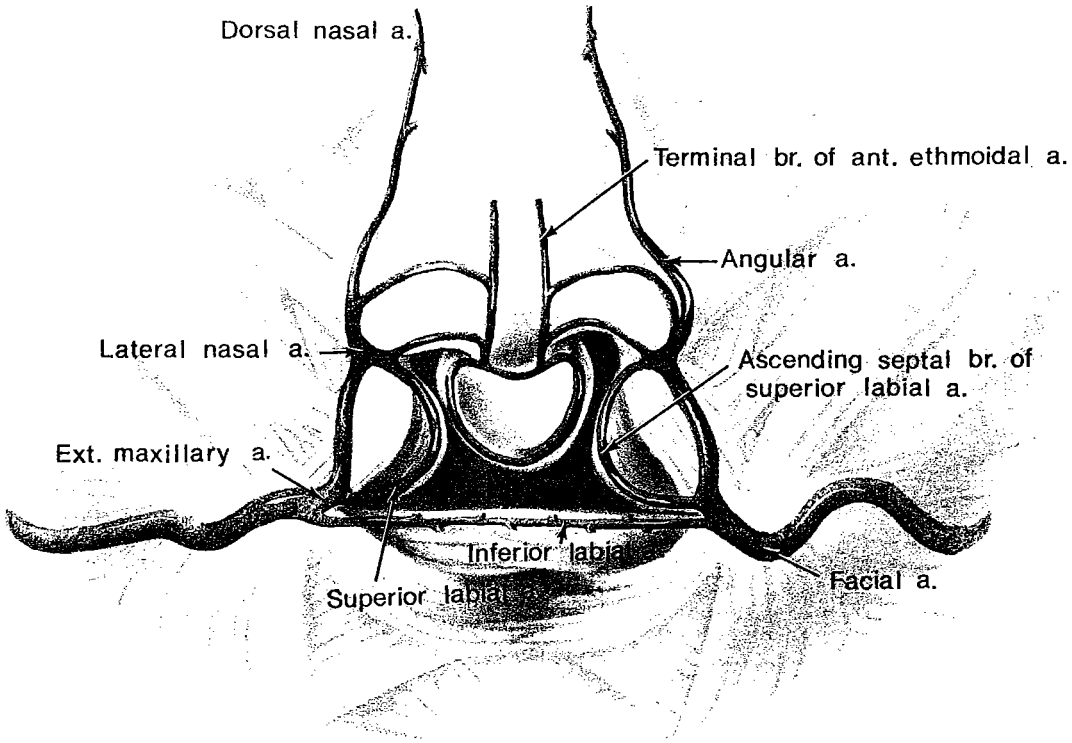
In the complete bilateral cleft the superior labial artery fails to unite with its fellow from the opposite side and contributes nothing to the blood supply of the philtrum. In addition to this, the arcade made up by the anastomosis of the posterior septal branch with the greater palatine artery through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

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

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

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

The bilateral cleft vascular pattern here portrayed with several corrections is drawn from the research of Slaughter, Henry and Berger.



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

BILATERAL NASAL DEFORMITY

In the normal person the premaxilla is held within the maxillary arch so that the growth thrust of the septum is cushioned in part by the anchoring of its union in the arch. The septal growth kick is responsible for forward growth of the maxillary arch, but its forward progress is not as great as that of the septum itself. The point of the septum is carrying the *tip of the nose* along with each *angle* of the medial and lateral crura of the *alar cartilage* and the *columella.* The proud advance of these structures is evidently dependent upon the distance the septum projects beyond the

premaxilla. Under these circumstances it might be conjectured that the most progressive nasal development is exemplified in the narrow high-bridged noses seen in British actors often playing the role of a butler, or even in the Middle East nasal humps and high nasal roots. By the same deductions the nasal flatness of the African Negro and the Oriental could represent a back step in nasal progress. It is interesting that in the nineteenth century reduction rhinoplasty was conceived and for over a century has been used and modified to produce noses that are neither too high nor too low but stand between these extremes.

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

SPREAD OF THE NASAL BASE

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

ALWAYS AN EYE ON THE NORMAL

The anatomy of the normal has been discussed in detail in Volume I, Chapter 2, but it is always a pleasure to review the

beauty of the normal and essential in order to use it as a guide in planning treatment and grading results.

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

thinner, yes, but the muscles do join across the lip.

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

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

NORMAL MEASUREMENTS OF NOSE AND LIP

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

Clifford and Pool reported in 1959:

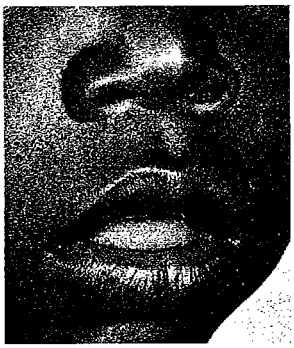
> The lips of 100 normal infants and children under the age of 5 years were measured. The vertical height was taken from the base of the nose to the peak of the cupid's bow at the white line of the vermilion. The average vertical height of a 1-month-old infant was 10 mm. At the age of 3 months this distance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

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

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

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

Male—Normal



Flared alae
Thick lip
Strong mucocutaneous ridge

Long lip

Short lip

Thin lip
Long columella

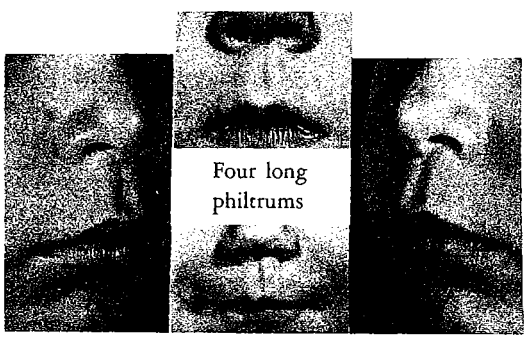
Long lip
Medium columella

Narrow philtrum ⟶

Wide philtrum
Short columella

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

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

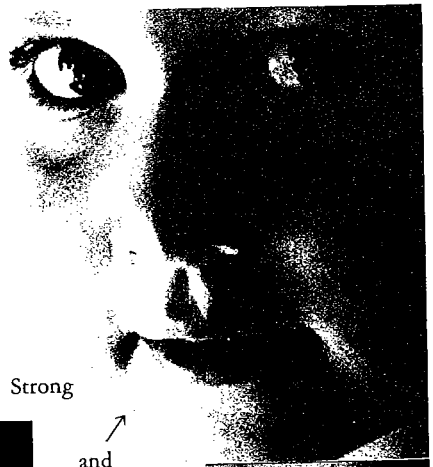


Four long philtrums

Female—Normal

Smiling a soft bow

Strong tubercles and white rolls



Strong

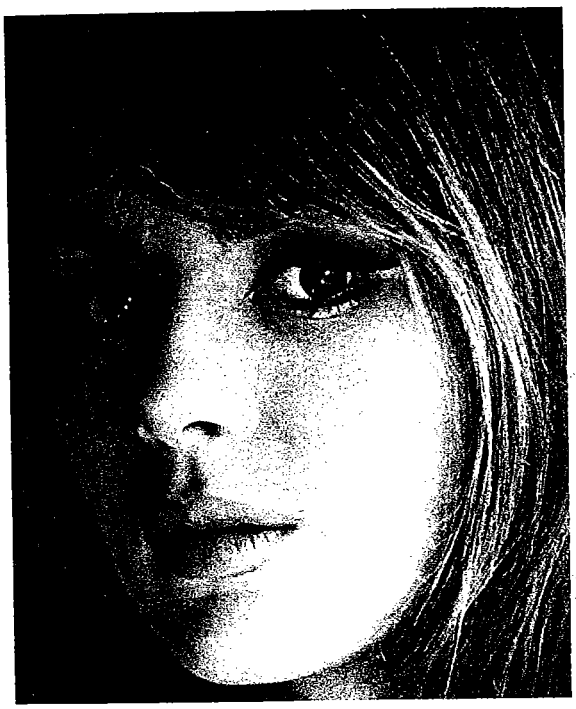
↗

and

long

philtrum

dimples



Lower ⅓ of incisors exposed at rest

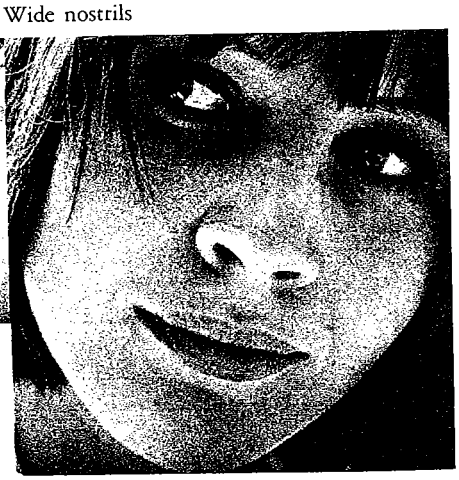
Wide nostrils

½ exposed with smile

All is shown with a laugh

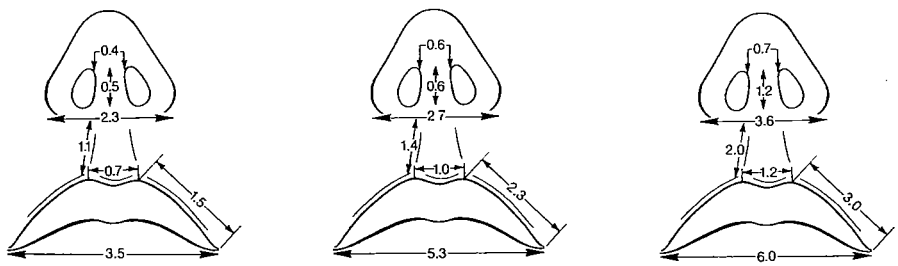
Strong bow

↑ Minimal bows and shallow dimples →



Averages in cm.

Age	Small Newborn	Normal Newborn				5 Years				Adults			
Race		Cauca-sian		Negro		Cauca-sian		Negro		Caucasian		Negro	
Sex		M	F	M	F	M	F	M	F	M	F	M	F
Nose 1. Columella height	0.5 (0.3–0.6)	0.4	0.4	0.5	0.3	0.7	0.6	0.5	0.5	1.3 (1.0–1.3)	1.2 (0.9–1.4)	1.2 (1.0–1.6)	0.9 (0.8–1.2)
2. Columella width	0.4 (0.3–0.5)	0.4	0.4	0.4	0.4	0.6	0.6	0.5	0.6	0.7 (0.6–0.8)	0.6 (0.5–0.8)	0.7 (0.6–0.8)	0.7 (0.6–0.8)
3. Nasal width	2.0 (1.7–2.1)	2.2	2.3	2.5	2.4	2.7	2.5	3.4	3.6	3.6 (3.3–3.7)	3.3 (2.8–3.6)	4.8 (4.6–5.1)	4.4 (4.3–4.8)
Lip 4. Vertical height (alar base to high point)	0.7 (0.6–0.8)	1.1	1.0	1.1	1.2	1.4	1.3	1.7	1.5	2.0 (1.3–2.2)	1.5 (1.1–2.1)	2.1	2.1
5. High point to commissure	1.4 (1.2–1.5)	1.5	1.5	1.6	1.5	2.3	2.3	2.3	2.1	3.2 (2.7–3.5)	2.9 (2.7–3.5)	3.1 (2.8–3.6)	3.0 (2.7–3.4)
6. Cupid's bow width	0.6 (0.5–0.8)	0.7	0.7	0.8	0.6	1.0	1.0	1.1	0.9	1.3 (1.0–1.6)	1.2 (0.7–1.3)	1.2 (1.0–2.0)	1.2 (1.0–1.8)
7. Commissure to commissure	2.6 (2.2–2.8)	3.3	3.5	3.8	3.0	5.3	5.2	5.3	5.1	6.3 (5.6–6.7)	5.7 (5.3–6.2)	7.2 (5.6–7.5)	5.7 (5.0–6.6)
Total number of cases	10	20	15	20	12	20	20	20	20	40	40	30	30



Averages: Newborn 5 year Adult

ABNORMAL SURFACE ANATOMY FROM THE SURGEON'S VIEWPOINT

In this deformity there are two clefts with double the varying amounts of missing composite tissue, bone, muscle, skin and mucosa. There is shortness in the vertical length of the entire frontonasal component from the nasal tip to the mid-inferior edge of the prolabium vermilion, the discrepancy being most noticeable in the length of the columella and prolabium. There is more than double the number of absent landmarks and double

the amount of disarrangement of what anatomy is present. There is no vestige of the normal cupid's bow, philtrum dimple and columns and nostril sill with which to compare or imitate; in fact, vestiges even to preserve are minimal.

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

THE VARIATION IN BILATERAL CLEFTS

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

IN THE COMPLETE DOUBLE CLEFT

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

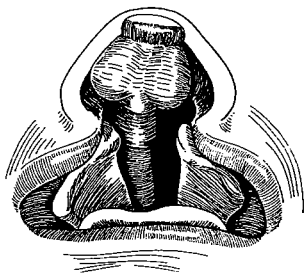
The central portion or prolabium is thin, totally expressionless

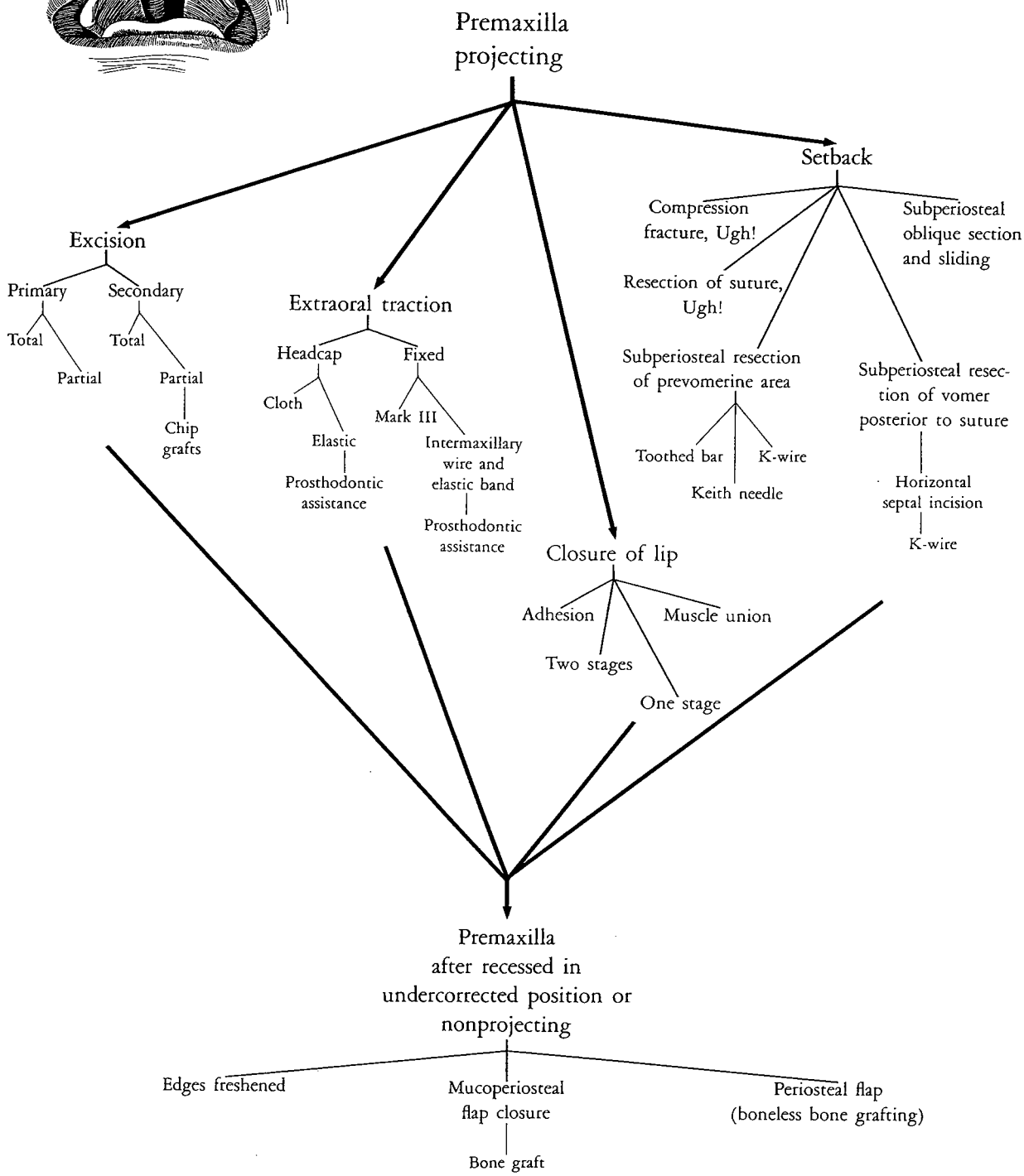
and often convex in contour. It is round in shape and can vary in size from a minute (millimeters) nubbin to a large (centimeters) Ping-Pong paddle. It is composed of skin in front but is plastered to the premaxilla behind with little or no labiogingival sulcus. There is subcutaneous tissue in varying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

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

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

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




Premaxilla projecting
Excision
Primary
Secondary
Total
Partial
Total
Partial
Chip grafts
Extraoral traction
Headcap
Fixed
Cloth
Elastic
Prosthodontic assistance
Mark III
Intermaxillary wire and elastic band
Prosthodontic assistance
Setback
Compression fracture, Ugh!
Resection of suture, Ugh!
Subperiosteal oblique section and sliding
Subperiosteal resection of prevomerine area
Toothed bar
K-wire
Keith needle
Subperiosteal resection of vomer posterior to suture
Horizontal septal incision
K-wire
Closure of lip
Adhesion
Muscle union
Two stages
One stage
Premaxilla after recessed in undercorrected position or nonprojecting
Edges freshened
Mucoperiosteal flap closure
Bone graft
Periosteal flap (boneless bone grafting)