

CLEFT LIP SURGERY

a practical guide

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About the video

The 3 operations as described in this book you can see on video. You'll find the videos at <http://www.agaveclinic.com/EN/cleft.php>.

Bart van de Ven is the surgeon who performs the operations.

This video will surely help you, in combination with the book, to gain good insight in these operations. It is a perfect complement to the book as not everything can be easily described in words and static images.

Preface

The idea behind this book is to explain in simple and clear terminology how a primary lip closure in a cleft patient can be performed. There are of course many excellent and beautiful textbooks as well as articles on cleft surgery, but here you find one with simple straightforward guidelines. We included many pictures, drawings and pictures to approach the subject three dimensionally. The focus is on the illustrations and not on the text. The methods presented here are well founded and universally recognized, but other and different techniques can lead as well to outstanding results.

The way to go is to build a vast body of experience in performing those surgeries repetitively—strengthened by a systematic and strong methodology. If you follow this book step by step, you have a framework to perform the surgery and the results will be very acceptable. Of course, postoperative results will improve with more experience. All of us, once, had to assimilate those surgical skills. It took time, discussion and growing maturity, and... it did not happen over night.

We hope this booklet can help you to improve your results over time and bring you to a point of confidence and no operational stress. There is still a great demand for people that can perform those surgeries, especially in developing countries. This booklet can be your guide and your rewarding friend.

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 Maxillofacial Surgeons

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1**

Anatomy Cleft lip

Illustration 1:
Anatomy of the normal lip.



Illustration 2:

Anatomy of the unilateral cleft lip.

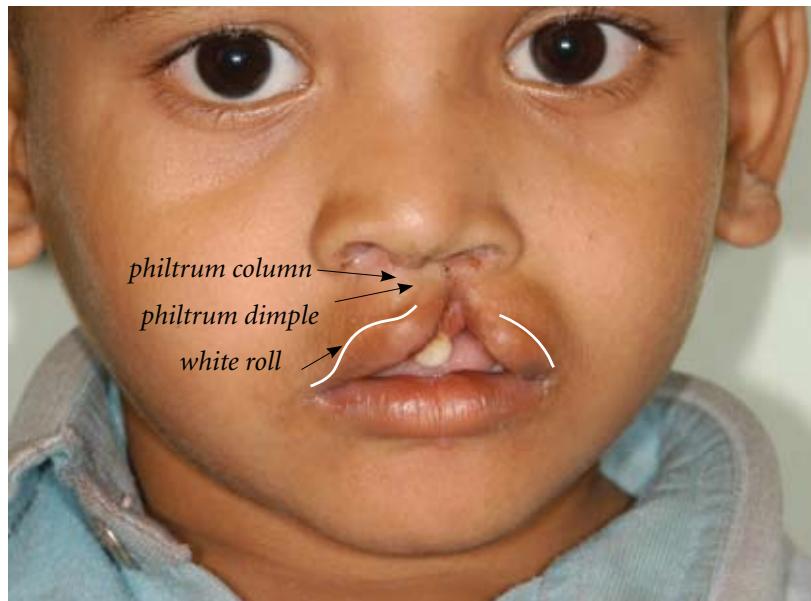
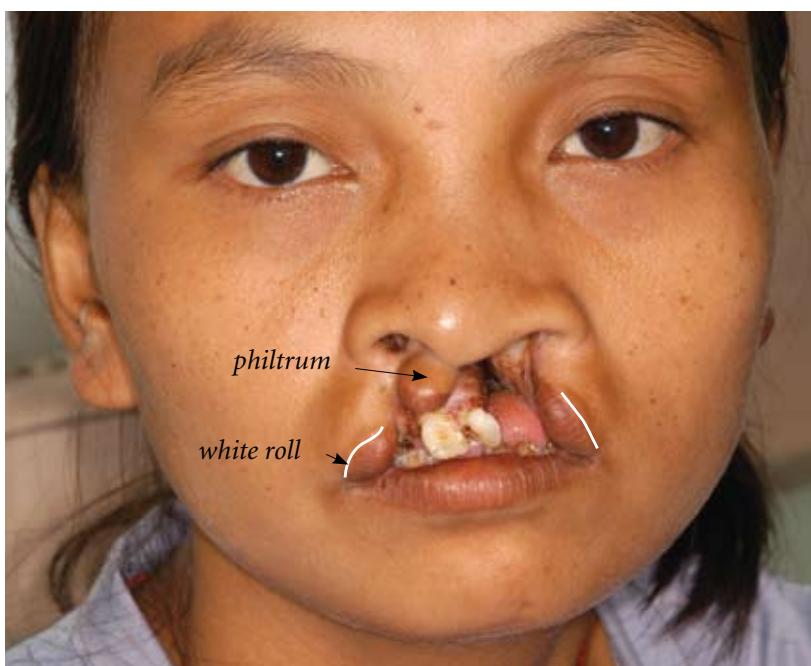


Illustration 3:

Anatomy of the bilateral cleft lip.

Notice that the philtrum doesn't have a dimple or a column because there is no muscle. Also the white roll is missing under the philtrum.



PART 2

Some practical tips

USE OF METHYLENE BLUE FOR THE LANDMARKS

We always start by marking a standard series of landmarks. Most people use methylene blue on a sharpened wood stick. Once you are sure the landmarks are in the right position, you can turn them in temporary tattoo landmarks with methylene blue on a needle tip.



Practical tip

First mark the points with a wood stick, sharpened and dipped in methylene blue. Then tattoo the landmark points with a 23 gauge needle tip. Dip the needle point in a 2cc syringe where only the very beginning is filled with a good quality of methylene blue. Tattoo the points with a repetitive fingertip rotating movement and almost no pressure. A bleeding point can indeed be very disturbing for your design.

If you go abroad, bring your own methylene blue since the quality abroad can be very disappointing.

SUTURING MATERIAL



Practical tip

For suturing we use the following material:

- *Positioning of the alar base of the nose:* PDS 5-0
- *Mucosa and subcutis:* vicryl 5-0
- *Muscle slings:* maxon 5-0
- *Skin:* catgut 6-0

Catgut has the advantage of being resorbable in 5-7 days. In Western countries however, its use is forbidden because of the mad-cow disease. In development countries you can still buy and use it.

If the necessary aftercare for suture removal is available, a nylon suture 6-0 can be used as well to close the skin.



**PART
3**

Unilateral Cleft lip

Introduction

Two basic techniques are universally in use for unilateral cleft lip closure: the Tennison-Randall procedure and the Millard procedure. Both techniques recognize the importance of repositioning the lip muscle (*orbicularis oris*) in a correct anatomic orientation that results in an aesthetic as well as a functional improvement.

The popularity of the triangular flap technique (Tennison-Randall) diminished in the 1970 to 1980s with the gaining popularity of the Millard procedure. However the triangular flap again gained popularity with widespread practice in many highly regarded institutions. So, both techniques must be considered essential in the armamentarium of the cleft surgeon.

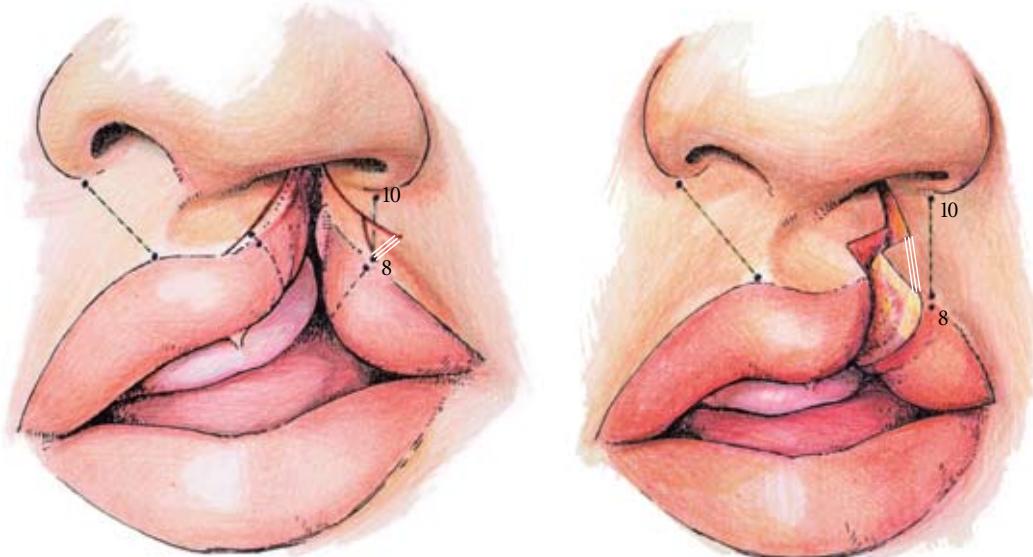
TENNISON-RANDALL PROCEDURE

The Tennison-Randall procedure is known as a geometrical design requiring exact pre-surgical measurements. Once the basic principles of cleft lip repair are fully understood the operation is fairly straightforward and should lead to pleasing surgical results. The operation is done strictly on mathematical principles and measurements. There is little room for surgical flexibility and artistry. This is most of the time and for most of us an advantage since errors in surgical artistic licence are common and never far away.

An important *advantage* of the Tennison-Randall procedure is the *lip lengthening effect* between the alar base and the Cupid's bow on the affected side (distance 8-10).

Illustration 4:

The lip lengthening effect of the Tennison-Randall procedure on the lateral side of the cleft.



The *disadvantage* however is the disturbance of the aesthetic unit of the CS philtrum column in the lower third. This is a violation of a known anatomic subunit, but not always that obvious. The philtrum dimple has a tendency to be more flat in the classical Tennison. This is no longer the case if the basket-weave method of interlacing the orbicular muscle is used.

MILLARD PROCEDURE

The Millard procedure is known as the rotation-advancement technique. It is a more flexible technique – cut as you go – but needs more experience and artistry.

The **advantage** of this technique is that it camouflages the violation of the philtrum column near the nose.

The **disadvantage** however is that one can easily get a vertical scar contracture with *vermilion notching of the lip or lowering of the alar base*. Horizontal scar contracture provokes a tendency towards a *small nostril*. Excessive narrowing of the nostril is never far from reality and the surgeon should simply aim for a slightly larger nostril on the cleft side.

In most articles you will find that pre-surgical measurements are less important in the Millard procedure. But small mistakes in judgement, even by excellent surgeons, can quickly translate into irreversible cosmetic concerns. Therefore we think that measurements are equally as important in the Millard technique as in the Tennison-Randall technique.

Illustration 5:

The Millard procedure just before the closing procedure.



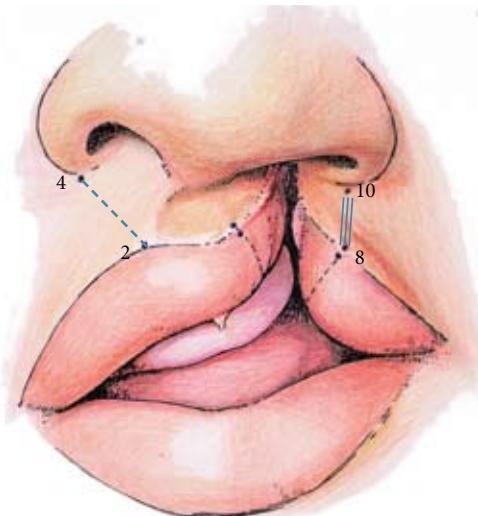
THE CHOICE

Roughly speaking, we use the Millard technique for the partial cleft and the Tennison-Randall for the wide open clefts.

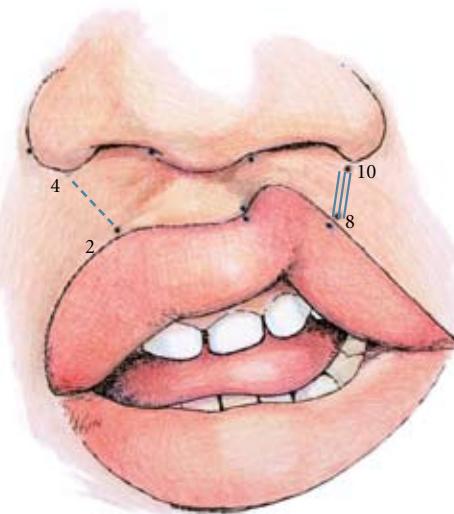
The ultimate decision comes from measuring the **distance between the alar base and the end of the white roll** on the cleft side (CS). Compare this distance with the non-cleft side (NCS). Most often you will see that the CS is smaller. *If the distance on the cleft side (8-10) is more than 2-3mm shorter than on the NCS (4-2), we use the Tennison-Randall technique. If it's less than 2 mm shorter, we use the Millard procedure.*

Illustration 6:

A wide open cleft lip, where a Tennison-Randall is recommended because the CS is more than 2 mm shorter.

**Illustration 7:**

A partial cleft, where a Millard procedure is recommended because the CS is less than 2 mm shorter.



The reason is as follows: if the **difference is more than 2-3 mm**—like in most *complete clefts*—you need to find a way to compensate because if the lengthening is not properly realized the operation will end up with *vertical discrepancies in the lip architecture* that catch attention right away.

The *Tennison-Randall* compensates by bringing in a triangle of extra tissue. The *Millard* lengthens the lip medial by straightening a curved incision. But laterally the lip is not lengthened. The alar base will be positioned too low, or the Cupid's bow will be pulled up (*Lazarus DD and co; "Repair of unilateral cleft lip: a comparison of five techniques"* in ANN PLAST SURG, 1998, DEC;41(6):587-94).

Illustration 8:

Alar base on the operated side (10) is too low after a Millard operation. A Tennison-Randall would have been a better choice.

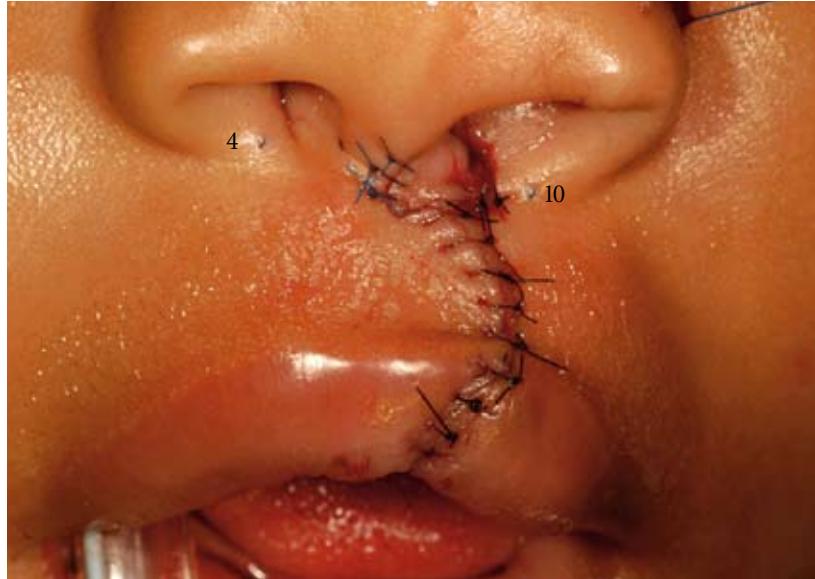


Illustration 9:

The Cupid's bow is pulled upwards on the operated side after a Millard operation. A Tennison-Randall would have been a better choice.



In the *Millard* procedure, the only way to sail around is to place the end of the white roll on the CS (8) more laterally. This shortens the lip horizontally on the cleft side, but small differences in lip width do not show as obviously as even the most subtle asymmetry in the lip height. But there are aesthetical limits to how lateral one can go.

Sometimes however the **difference is less than 2-3 mm**—like in most *partial clefts*. The length of the alar base to the end of white roll is comparable to the other side, and sometimes even longer and more voluminous.

The *Tennison-Randall* technique then creates a too long lip on the affected side, since you bring in a triangle of extra tissue. The *Millard* technique perfectly suits these cases.

Tennison-Randall procedure

Illustration 10:

Cutting design for the Tennison-Randall procedure.

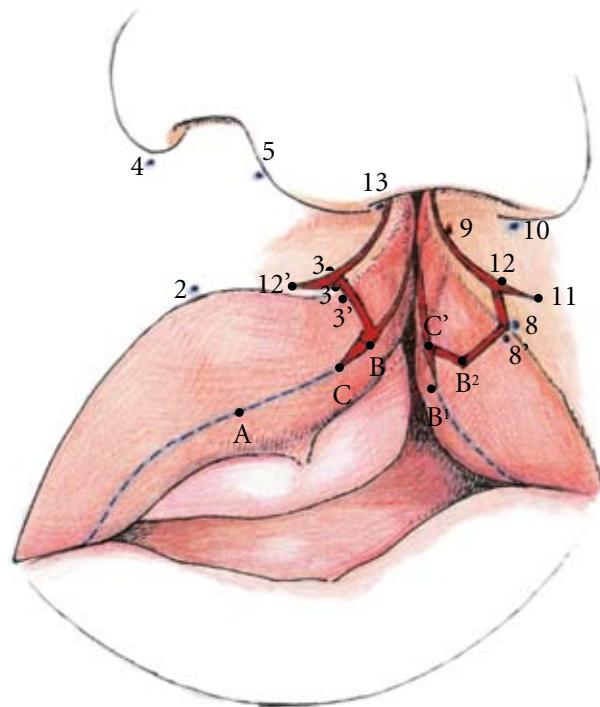


Illustration 11:

Tennison-Randall procedure after cutting.

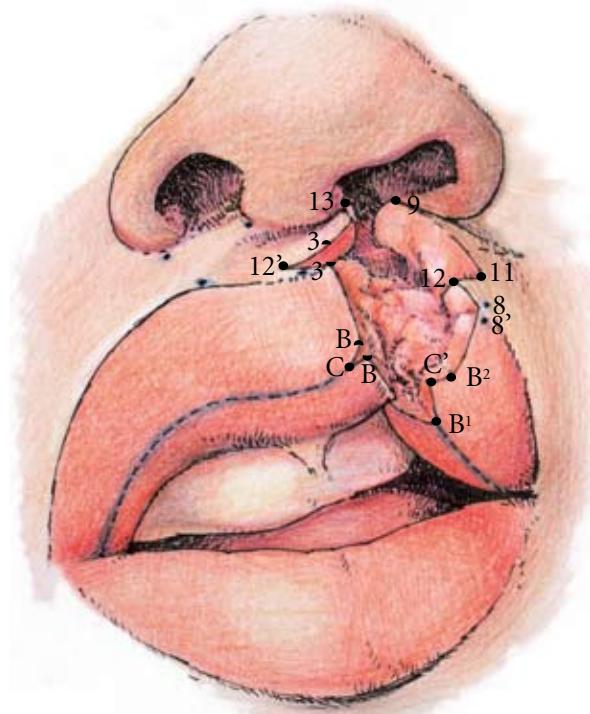
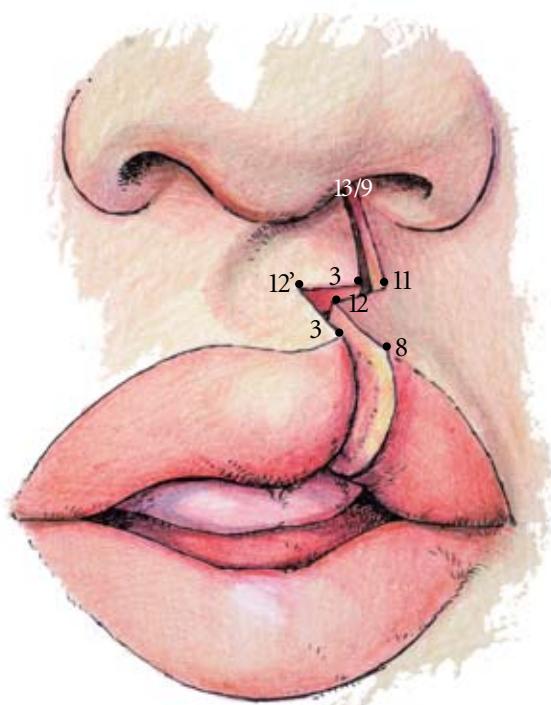


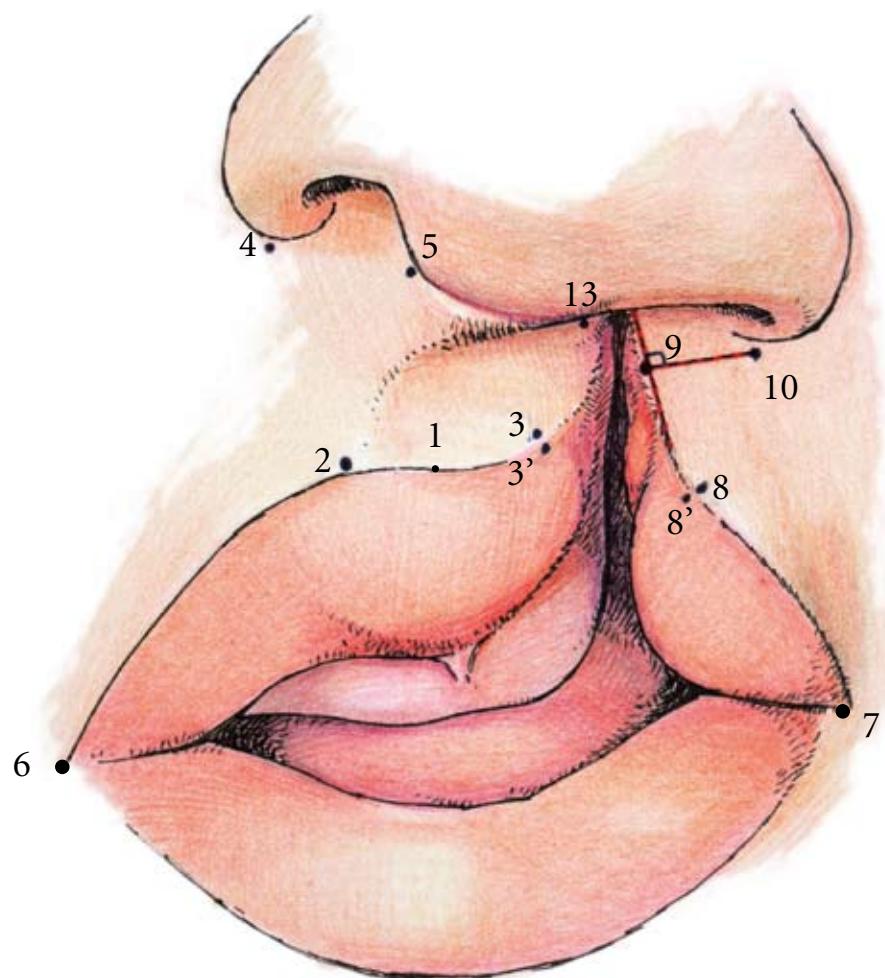
Illustration 12:

Tennison-Randall just before closure of the skin and mucosa.



LANDMARKS

Illustration 13:
Nasal and vermillion border landmarks for the Tennison-Randall design.



NASAL LANDMARKS

Landmark 5 and 13 First mark the end of the medial crus of the lower lateral cartilage. This landmark is considered the columellar base. The German name for this landmark is famous: 'Naseneingangschwelle'. This is landmark (5) on the non-cleft side and landmark (13) on the cleft side.

Illustration 14:
Marking landmark 13 at the end of the medial crus of the lower lateral cartilage.



Landmark 4 and 10 Mark the *alar bases* as landmarks (4) and (10). These landmarks are found at the end of the light reflection on the nostrils. It is most important that both landmarks are in a comparable position right to left, otherwise your measurements are meaningless.

These four landmarks are made close to the cartilage in order to allow for maximum rotation of the alar base.

VERMILLION BORDER LANDMARKS

Landmark 2, 3 and 1 Landmark (2) is the top of the Cupid's bow on the healthy side and is easy to locate. Therefore it is tattooed right away.

Landmark (3) is the end of the white roll on the NCS, it represents the other end of the Cupid's bow. Landmark 3 is tattooed as well.

Landmark (1) is chosen as the middle of (2) and (3). It represents the middle of the Cupid's bow.

Landmark 8 On the lateral or cleft side (CS) we still need to establish the peak of the Cupid's bow. This is landmark (8) and is the end of the white roll on the CS.

The distance between the commissure on the non-cleft side and the Cupid's bow landmark (6)-(2) is measured and transferred to the cleft side. Almost universally the available distance (7)-(8) is shorter. This gives an idea of the amount of shortening of the lip on the CS.



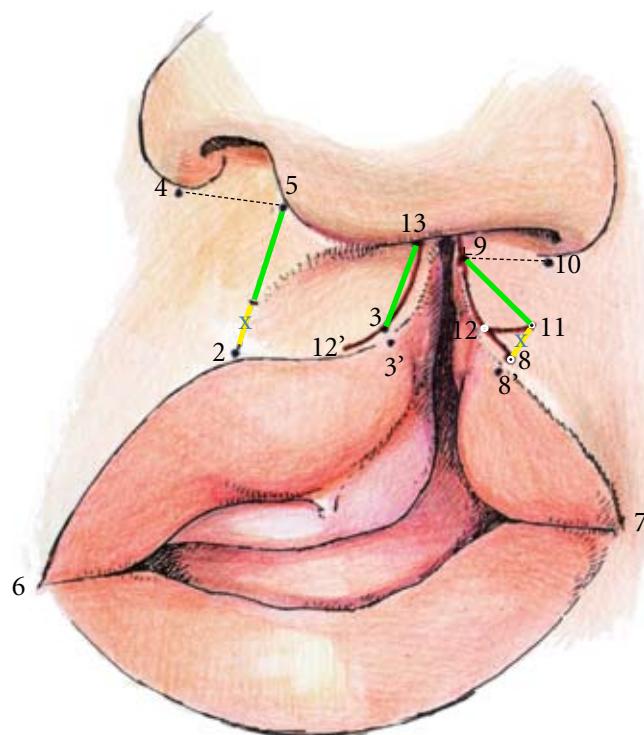
Note on landmark 8

Shorter means that the lip at the end of operation will be shorter on the CS. This is not so obvious or disturbing on first sight and tends to fade away during life. What on the other hand is obviously disturbing is a Cupid's bow too high or a nostril too low. This catches the attention right away.

Landmark 3' and 8' On both sides of the cleft landmarks (3) and (8) are the paring peaks of the Cupid's bow and they are marked twice: One landmark is marked just above the white roll (3 and 8) and one landmark is perpendicular to the white roll just in the red lip (3' and 8'). The distance between both upper and lower landmarks is on average 1,5 mm. It is most important that this little distance is equal on both sides. These four cardinal landmarks should stay clearly visible during the whole surgery. Suturing these landmarks at the end of the procedure will create the new Cupid's bow top with a close to normal white roll, in a continuous mode and without steps.

SKIN TRIANGLE LANDMARKS

Illustration 15:
Measurements for the triangular design.



The distance from landmark (5) to (2) should finally become the lip length on the cleft-side too. Since length (13)-(3) is 'x' shorter than (5)-(2), 'x' must be added to establish equal length. We bring this in as a triangular skin flap from the cleft side with a base of 'x'.

This triangular skin flap, after incision, will be brought in via a deep incision from (3) to (12'), thus splitting (3). Later, the upper half of (3) will be sutured to (11), the lower half to (8). This reconstructs the lip with a normal contoured Cupid's bow and a zigzag scar line, which also prevents vertical scar contracture.

Landmark 11

Landmark (11) is situated at a distance 'x' from landmark (8) perpendicularly away from the white roll.

Landmark 9

Landmark (9) is paramount because it defines two structures on the affected side: the width of the nostril and the length of the lip.

Landmark (9) should be located on a distance (3)-(13) from landmark (11), on the border between skin and mucosa. This distance determines in part the *length of the lip*.

Also the distance from the alar base (10) to landmark (9) should be identical to the distance (4)-(5) on the normal side. This will determine the *width of the new nostril*. Indeed landmark (9) will be sutured to landmark (13).

For the nostril landmark (9) is ideally situated on a perpendicular line from the alar base on the affected side to the border between skin and mucosa and exactly on this border. If this is not the case, see note.

**Note on point 9**

If landmark (9) is not situated on a perpendicular line from the alar base to the border between skin and mucosa, adjustments have to be done, solo or in combination :

- move point 9 more inside the nose,
- move point (11) of the triangular flap somewhat towards the corner of the mouth,
- move point (11) a bit up, thus enlarging the base of the triangle.

Landmark 12 and 12'

Finally we mark a third landmark (12). It is facing the cleft and is the top of the more-or-less 'equally sided triangle'. This landmark should be chosen as close to the vermillion border as possible, in order to save as much skin as possible. The homologue landmark on the NCS is (12'), located just above the white roll on a distance x from (3).

**Practical tip**

The positions of landmark (9), (11) and (12) are related to one another. Practice is that you choose their positions by eye-balling and marking them with the wooden stick. After that you check by caliper measurements, choose their final positions and indicate them with small tattoos.

MUCOSAL TRIANGLE LANDMARKS

The next effort in design is dedicated to the symmetry and natural fullness of the mucosal part of the lip, with a symmetrical flowing of dry and wet tissues.

Wet-dry border

First, determine the wet-dry border. Mark these lines, on both sides, with the wooden stick dipped in methylene blue.

**Practical tip**

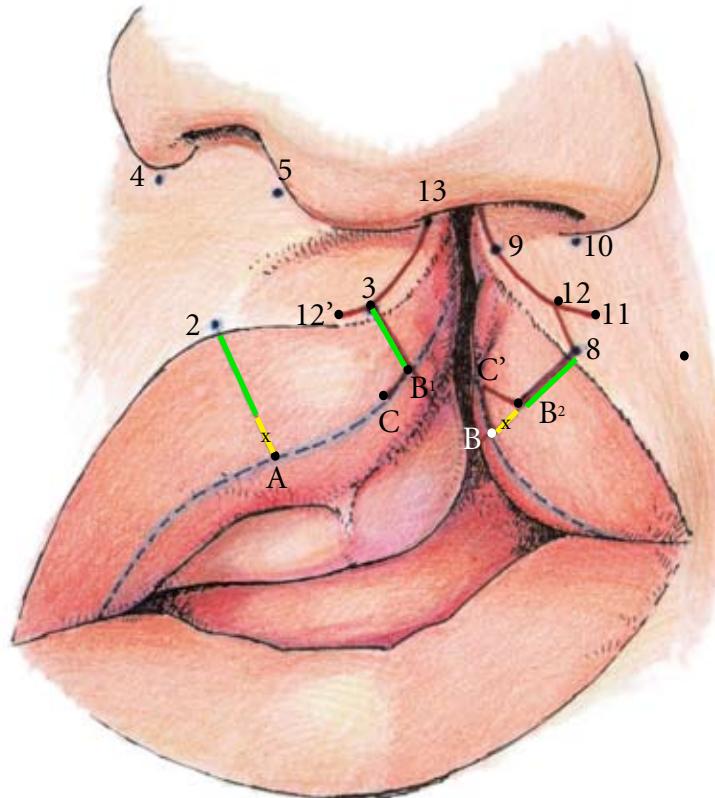
To find the wet-dry border: apply moderate pressure with the volar side of the index finger along the white roll of the lip. On the highest profile, CS and NCS, draw a line with methylene blue.

Illustration 16:
Marking of the wet-dry border.



Illustration 17:

Measurements done to obtain symmetrical volumes of the mucosal part of the lip.



The distance from landmark (2) to (A) should finally become the lipmucosa length on the side of the cleft too. Distance (3)-(B¹) is too small, compared to (2)-(A), therefore a triangular piece of mucosa is taken from the cleft side and is brought in via a deep incision to the opposite side. Since length (3)-(B¹) is 'x' shorter than (2)-(A), 'x' must be added to establish equal length.

Landmark A and B

Measure the distance between landmark (2) and the wet-dry border in a perpendicular fashion. This distance (2)-(A) is the reference for the pair side (there is no need to tattoo landmark A). The same distance is measured on the CS lip from (8) to the wet-dry border. This is most often not done in a perpendicular way since the lip is often thinner near this side, so (B) is chosen more laterally on the CS lip. This landmark (B) is clearly indicated with a needle dipped in methylene blue.

Landmark B¹ and B² Then measure the distance from landmark (3) perpendicular to the blue line, and tattoo landmark (B¹). Deduct this distance (3)-(B¹) from distance (8)-(B) to find landmark (B²).

Landmark C and C' Choose landmark C' on the wet dry border on the cleft side in such a way you create a more-or-less equally sided mucosal triangle.

Create landmark C on the wet-dry border on the non-cleft side, on such a distance from (B¹) that the mucosal triangle will nicely fit in—approximately the distance (B)-(B²).

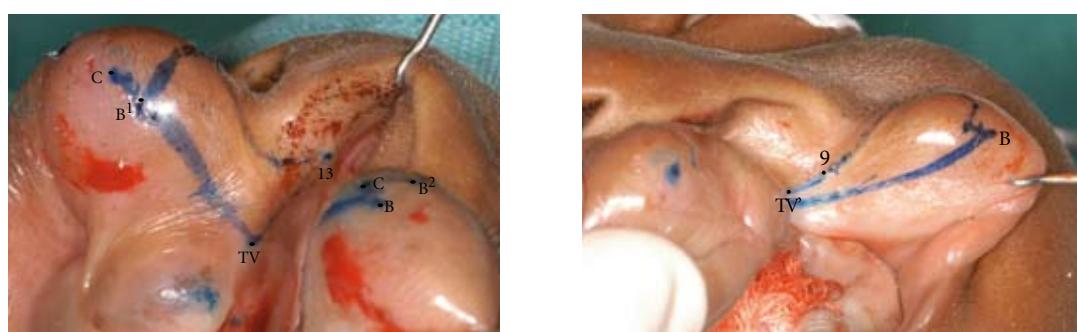
Distance (B)-(B²) is the base of an equal-sided triangle, with one side of the triangle lying along the blue line. This full body mucosa-muscle triangle, after incision, will be brought in a deep incision from (B¹) to (C), thus splitting (B¹). Later, the upper half of (B¹) will be sutured to (B²), the lower half to (B). Landmark (C') will be sutured to (C). When this is done appropriately the lip comes close to symmetry and natural fullness.

VESTIBULAR LANDMARKS

Landmark TV and TV' To complete our design we need to tattoo two more landmarks: the vestibular tops on both sides of the cleft—where the alveolar process starts. On the NCS, this is landmark (TV). On the cleft side we mark the same landmark as (TV'). This landmark, though, is more arbitrary than landmark (TV).

Illustration 18:

Landmark TV (non-cleft side) and TV' (cleft side).



INFILTRATION

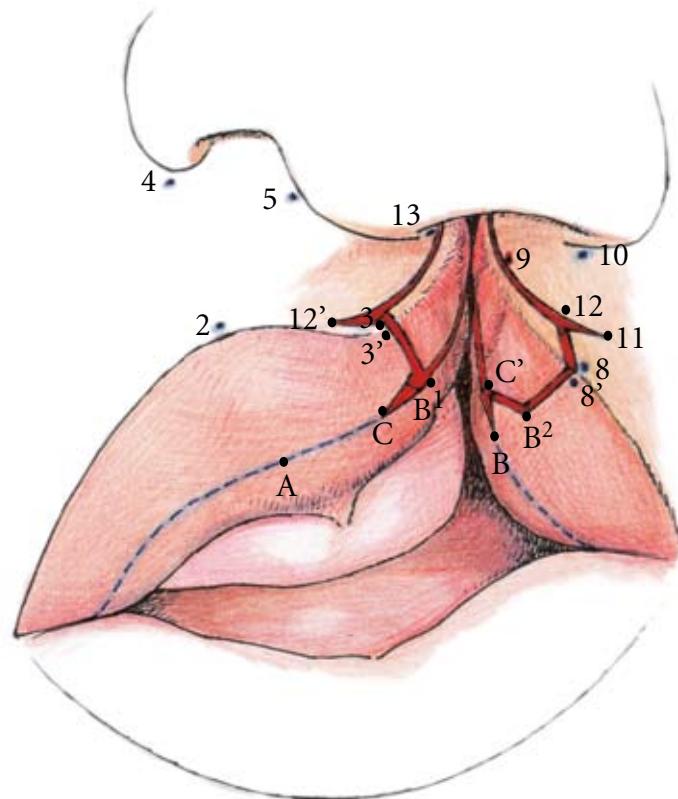
Infiltration is started in the lip and nose with local anesthesia/adrenaline. To enlarge dimensions and prevent bleeding of the superior labial artery, pump the lips up quite firmly (2-3cc). For good vasoconstriction wait 5-10 minutes. Use this time to make your 'cutting design' by connecting the landmarks.

**Practical tip**

Enter the infiltration needle away from the design area, since even a bit of bleeding is annoying.

CUTTING DESIGN***Illustration 19:***

Cutting design for the Tennison-Randall procedure.



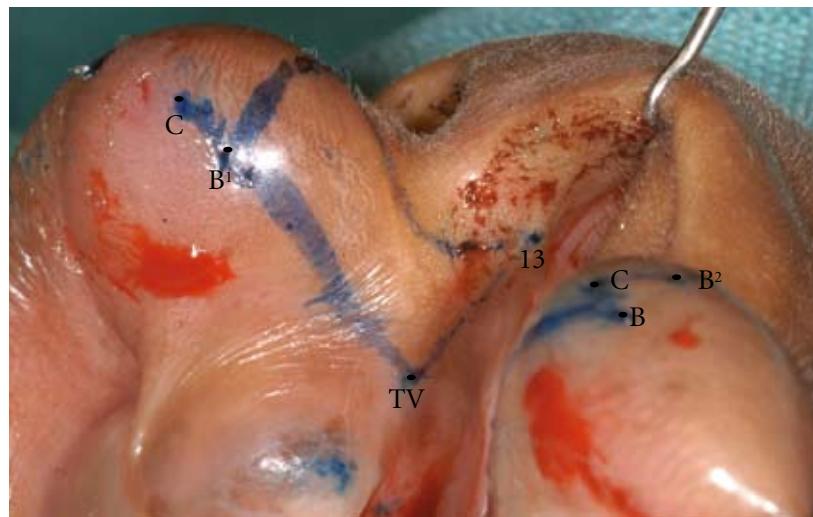
The cutting design is made with methylene blue and the wooden stick.

Muco-philtral design Connect most of the tattooed landmarks as shown in the illustration. Pay attention and be conservative in the tissues you disregard, especially on the mucosa-skin borders.

Muco-nasal design NCS From landmark (13), the *Naseneingangschwelle*, continue the design to the top of the oral vestibule (TV). For this, follow the border between the nasal skin and the oral mucosa, distinctive in color and texture. From (TV) the drawing is completed, returning along the wet-dry border to finally reach (B¹).

Illustration 20:

Cutting design for the anterior part of the nose on the non-cleft side.

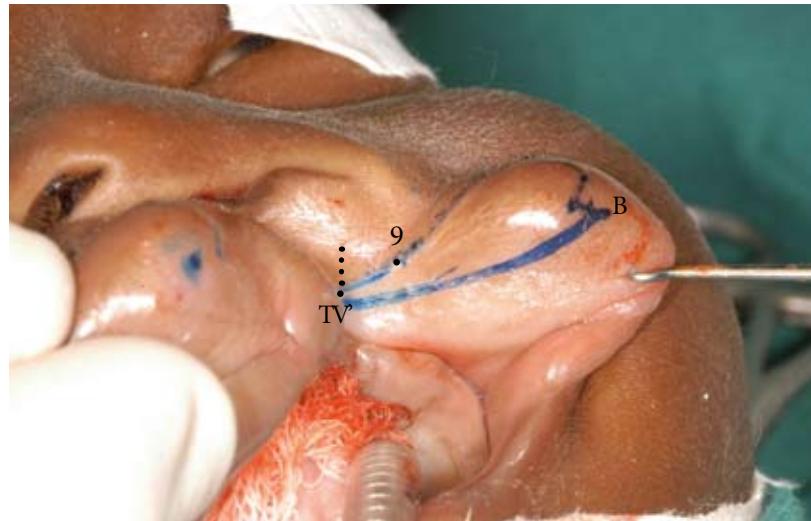


Muco-nasal design CS

From landmark (9) continue the design deeper in the nose along the border of the nasal skin and the oral mucosa. The end is (TV'), the top of the alveolar process on the cleft side. In order to be able to join the pair sides (TV) to (TV'), a small back cut inside the nose is necessary. Also some undermining is necessary along the line (9) to (TV') in order to bring (TV') to (TV) bridging the cleft gap. At the NCS undermining is almost impossible, therefore we do the undermining on the CS. This incision is also continued along the wet-dry border to reach landmark (B).

Illustration 21:

Cutting design for the anterior part of the nose on the cleft side.



CUTTING

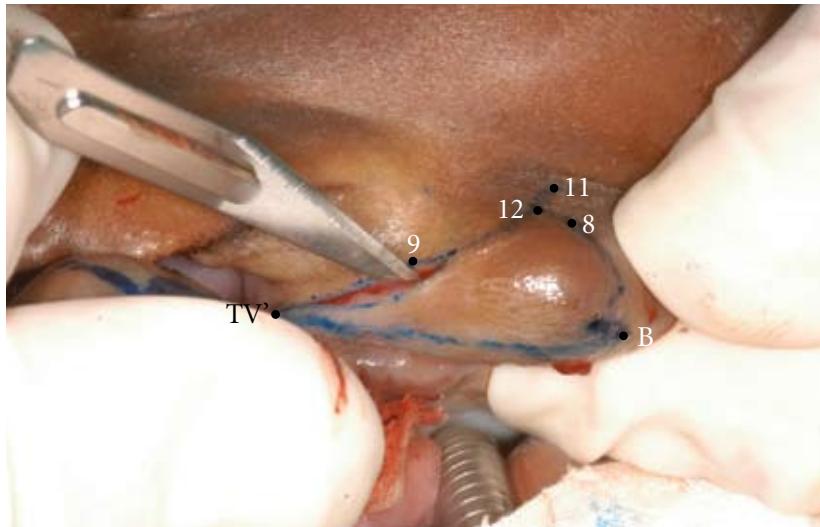
CUTTING OF THE MUCOSAL AND CUTANEOUS TISSUES

For the cutting procedure, use blade 11. Make no incision deeper than the submucosal or subcutaneous layer. This way there is no undue damage to the orbicular muscles. Remove the mucosal and cutaneous tissues in a conservative way. *Always have in mind your blue tattoo landmarks, and leave them in the not-to-be-removed part.*

Save as much tissue as possible. Use at least three fresh blades no. 11 for a single surgery, or combine the 11 blade with 15 blades.

Illustration 22:

Initial incision no deeper than submucosal or subcutaneous layer.

**Illustration 23:**

Removal of the mucosal tissues.



CUTTING FOR THE BASKET-WEAVE MUSCLE REPAIR

We believe the muscle interdigitating technique rests on a sound surgical basis and greatly helps to harmonize the lip structures where it is most stigmatizing: the muscular layer. Its promise, indeed, is to create an undisturbed functional and anatomical fair muscular unit around the 'once cleft' mouth.

**Note**

The technique is written down in the article of *M. Brent Seagle, M.D. and Leonard Furlow Jr., M.D.* in PLAST. RECONSTR. SURG. 113: 1537, 2004.

Start with a through and through incision separating the orbicular muscle in a caudal muscle part belonging to the mucosal lip and a cranial muscle part belonging to the skin part of the lip. This is done importantly at the level of the white roll. For the moment we leave the caudal muscle part untouched.

Dissect the cranial muscle part from the skin and the mucosa over a distance of 10 mm on the CS and 5 mm on the NCS. Do this in one cutting movement, fixing the lip firmly between thumb and index finger. Take special attention to free the muscle completely from the nasal spine on the NCS and from the alar base near the CS. You can use a dental periosteal (molt no. 9) to achieve this to its full extent.

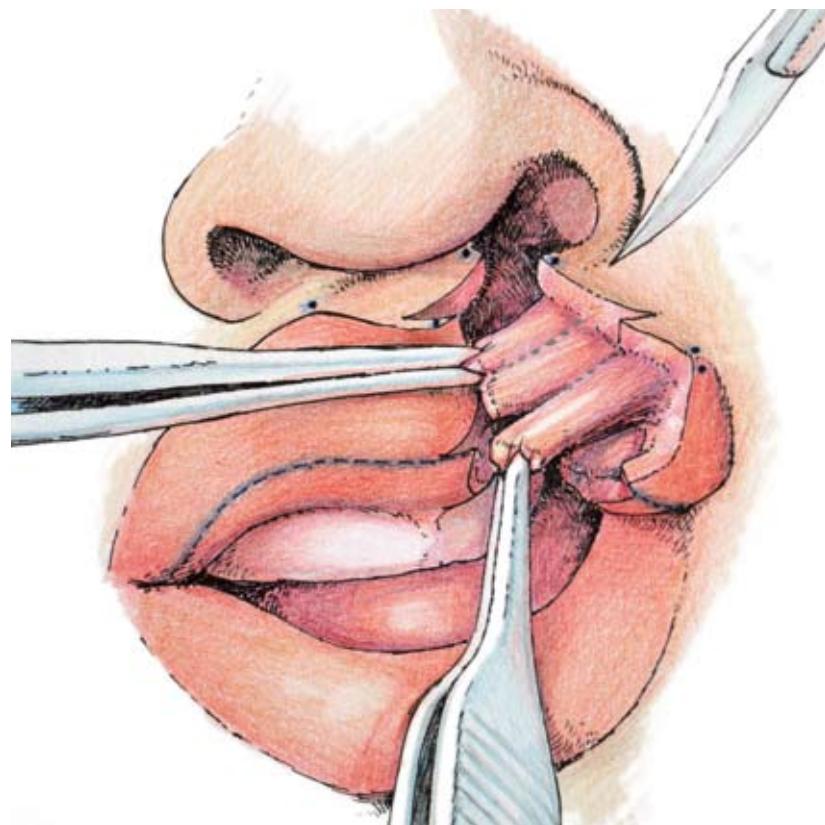
Cut the undermined cranial part of the muscle into 3 equal slices.

Illustration 24:

The cranial part of the orbicular muscle after dissection and before it is cut.

**Illustration 25:**

Cutting the orbicular muscle in three equal slices.



UNDERMINING OF THE ALAR BASE AREA

Alar base area

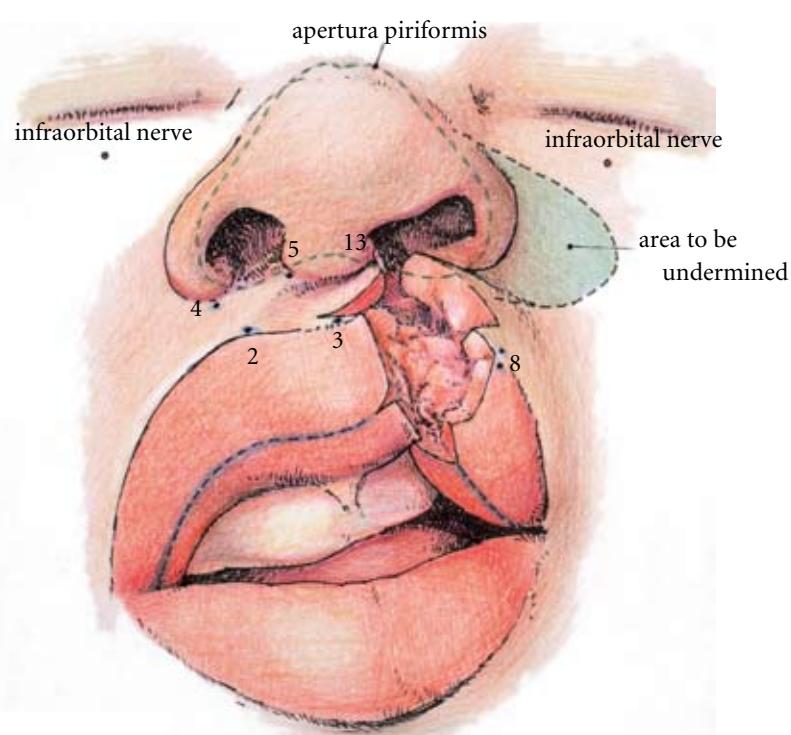
The alar base area can easily be reached from underneath the cranial muscle part. Release the alar pad from the alveolus with a pair of scissors and a molt no. 9. Elevate the soft tissues from the pyriform aperture in the supra-periosteal plane. Follow the pyriform aperture on the CS over the periosteum with a pair of scissors and undermine the cheek area until the cleft can be closed with no, or minimal, tension. Be careful not to damage the infraorbital nerve. Protect the nerve by putting your index finger on the infraorbital foramen.

Lower lateral cartilage

At this moment you might free the lower lateral cartilage on the affected side from the overlying skin with a blunt curved pair of scissors. If you do this, at the end of the operation you should exorotate the lower lateral cartilage and fixate it to the skin using mattress sutures. We tend not to do this in small babies because it causes unnecessary damage to the cartilage. We prefer to do a secondary rhinoplasty at a later stage.

Illustration 26:

Undermining of the alar base area.



SUTURING

TRY-IN OF THE SUTURE FOR THE ALAR BASE POSITIONING

Position the alar base using a PDS 5-0. This suture is important for two reasons. It levels both nostrils on the same height and it determines the width of the nostril. Pick up the areolar tissue directly under the alar base (10), with the PDS needle and come out exactly underneath landmark (9). Stay in the tissue, don't come out through the skin. Then pass the needle through the columellar base (13). Come out through the skin at its homologue landmark (5). Return from landmark (5), but in a slightly different direction in order to have some tissue in the loop.

Illustration 27:
Try-in suture for the alar base positioning.

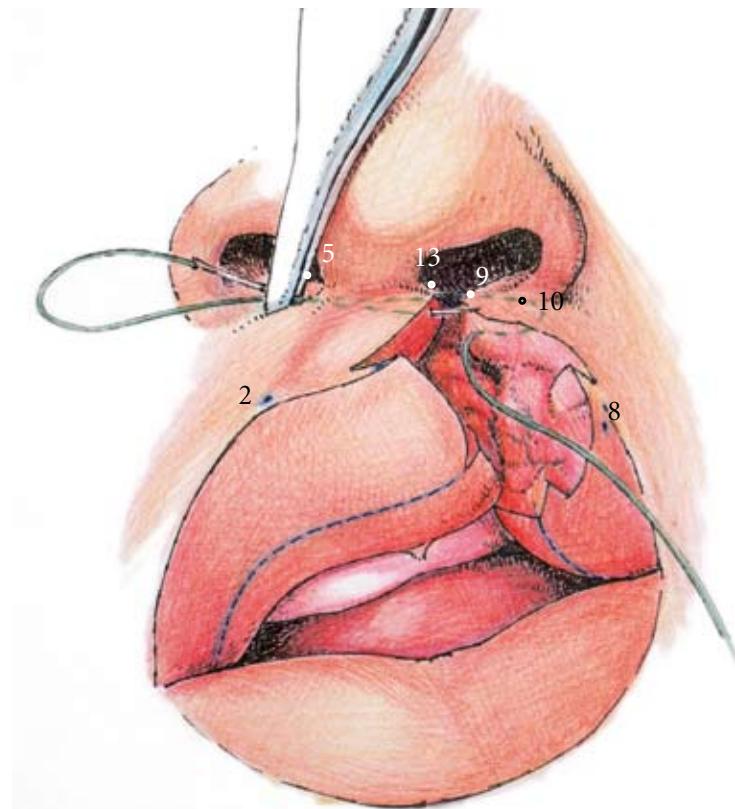
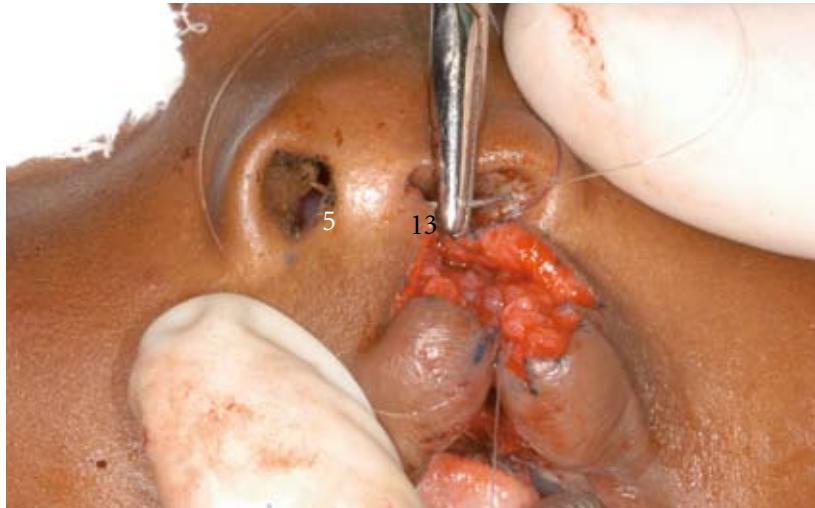


Illustration 28:

Passing the needle through the columellar base.



Now examine the result by temporarily tying the suture. This is the moment to accept or possibly redo the suture by carefully examining the 3-dimensional position of the alar base on the affected side (in the axial plane and the coronal plane).

Illustration 29:

Examining the position of the alar base after temporarily tying the suture.



If the suture seems fine, re-open the knot and attach a mosquito clamp to both ends of the suture.

The knot is to be finished at a later stage of the surgery, after the oral vestibule and the floor of the nose are sutured, otherwise access to the oral vestibule and floor of the nose will become difficult.

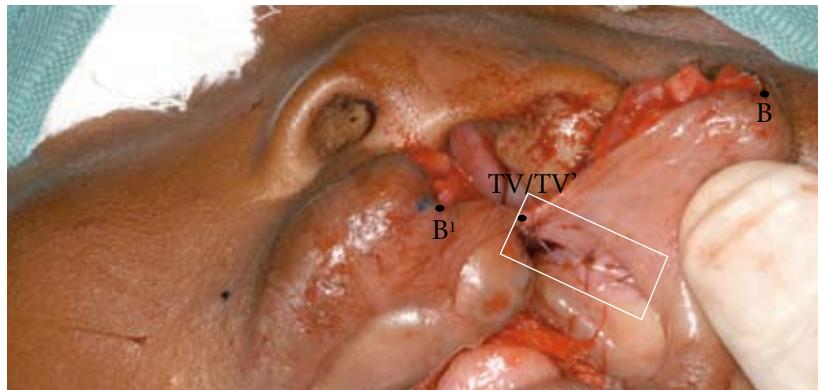
VESTIBULAR SUTURING

Vestibular border

Start first to make an incision from (TV') along the vestibular border, as long as needed to cross the cleft-gap without tension. Dissect this part of the vestibular mucosa. This incision in the vestibule releases the alar pad area from the alveolus.

Landmark (TV') of the CS finally has to be sutured to landmark (TV) on the NCS. To make this possible without tension start more laterally along the vestibular mucosa incision to put 2 or 3 intermediate sutures using vicryl 5-0 or polysorb 5-0.

Illustration 30:
Suturing of TV to TV'.



Vestibular lip

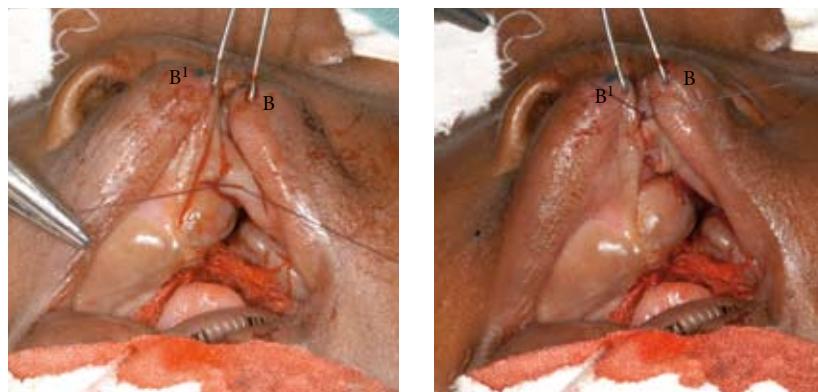
Then continue the suturing of the mucosal part of the lip from TV/TV' up to the wet-dry border (landmark B¹ and B).



Practical tip

Place a sharp double toothed retractor on the wet-dry-border (landmark B and B¹) and suture the inside from the vestibule to this border.

Illustration 31:
The suturing of the mucosal part of the lip.



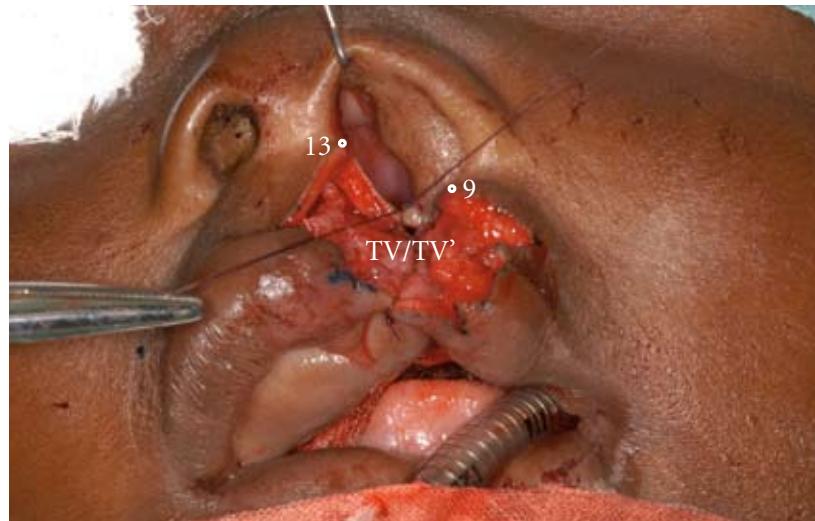
NASAL FLOOR SUTURING

The suturing of the anterior floor of the nose always starts posterior and proceeds anterior.

The nasal mucosa from landmark (9) to (TV') on the CS needs to be undermined and released and often there is a need for a right angled back-cut starting from (TV') lateral towards the lower concha in order to gain sufficient nasal mucosal tissue.

Start from the previously sutured TV/TV' and proceed anterior, with two or three stitches, to finally suture landmark (13) to (9).

Illustration 32:
Nasal floor suturing.

**ALAR BASE SUTURING**

Now is the moment to make the knot in the previously placed suture of the alar base.

BASKET-WEAVE MUSCLE SUTURING

In order to give the lip a more natural dynamic, as during whistling, we will attach the muscular slings to the subdermal layer as it is at the normal side.

To suture the cranial muscle layer, draw two vertical lines on the non-affected side to show where the muscle slings are attached to the skin. You can see where the muscles are attached to the skin. Mirror these two vertical lines to the affected side. The muscle slings from the CS are sutured against the subdermal layer on the NCS in three levels and vice versa. To mark these three levels divide the two lines on the affected side in equal parts.

Illustration 33:

Vertical lines indicating where the muscle slings should be attached to the skin.

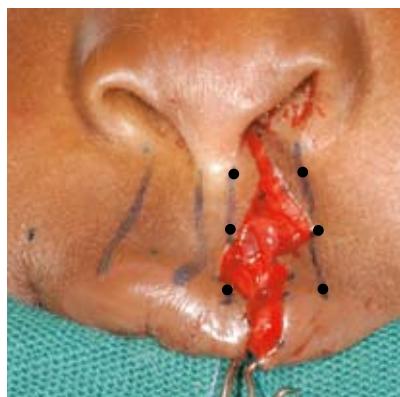


Illustration 34:

Normal lip during whistling. You can see where the muscle is attached to the skin.



The suturing of the muscle slings is carried out using maxon 5-0 (resorbable mono filament). Pick-up the upper muscle sling from the CS, go through the skin of the NCS in one direction, and come back through the same hole but in a different direction, in order to have some subcutaneous tissue inside your loop. Now pick up the upper muscle sling from the NCS and attach it in a similar way to the opposite site.

Skin incision triangle

Before suturing the lower muscle sling make the deep skin incision from landmark (3) to (12') in order to receive the triangular flap. If not, you risk cutting the lower muscle sling suture. The direction of this incision is parallel just above the white roll. Others prefer to direct the incision more into the skin and away from the white roll.

Illustration 35:

Going through the skin in one direction, and coming back through the same hole in a different direction.



Repeat the same procedure for the middle and lower muscle slings.

Illustration 36:

The basket-weave muscle repair.



CAUDAL MUSCLE LAYER SUTURING

After having sutured all six muscle slings, suture the caudal muscle layer belonging to the red part of the lip.

Do this with a vicryl 5-0 stitch going through the cranial part of the muscle parallel to and just below the white roll, with the knot on the deep side. This should bring the Cupid's bow and white roll in an exact pleasing position. Landmarks (3) and (8) should come close together, as well as (3') and (8'). If not, reconsider the stitch. There is no need to tighten the knot firmly, since this can disturb the flow of the skin suturing.

Illustration 37:

Suturing the caudal muscle layer belong to the red part of the lip.



FINAL CLOSURE SUTURING

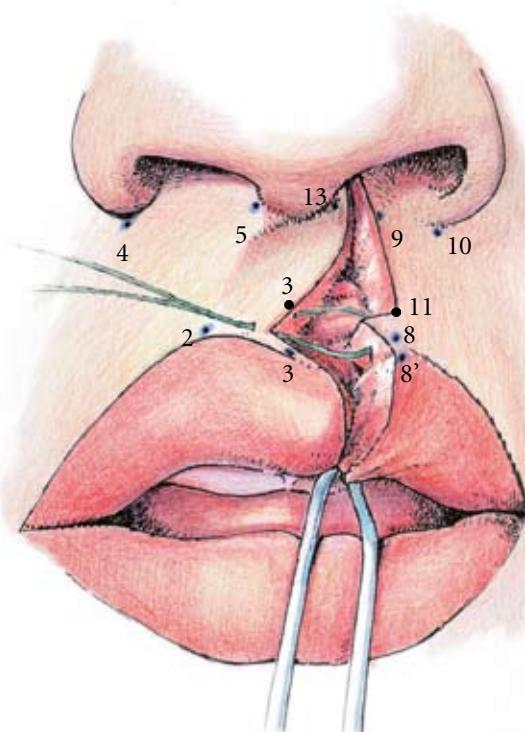
Incisions for triangles As indicated the incision on the NCS to receive the *skin triangle* should be done before the suturing of the lower basket sling.

To receive the *mucosal triangle*, make an incision from (B) to (C'). This incision is always along the wet-dry border.

Subcutaneous sutures Now use vicryl 5-0 subcutaneous sutures to bring the skin flaps into their correct positions. Start with a subcutaneous suture at the Cupid's bow landmark (3) and (8). Another important subcutaneous suture is one from landmark (11) to (3). Making both of these subcutaneous stitches should give you a sensation of relief and joy, as the wound edges over the whole line finally fall naturally and fluently.

Skin suturing Suture the skin with catgut 6-0 (in developing countries this is still easy to get). If you have the opportunity to remove the sutures after 5 or 6 days, you might prefer to use nylon 6-0.

Illustration 38:
Suturing the skin triangle.



Mucosal triangle

Suture the mucosal triangle with vicryl 5-0 into the opening in the wet-dry border. Finish by suturing the rest of the mucosal lip.

SILASTIC SHEET SUTURING

You could suture a little roll of silastic sheet into the operated nostril and fix it to the septum with a PDS mattress suture. Leave it in place until the PDS has resorbed and the sheet comes out by itself. The sheet will support the lower lateral cartilage to obtain a more rounded nostril.

Illustration 39:

Roll of silastic sheet fixated to the septum inside the operated nostril.



Unilateral Millard Procedure

INTRODUCTION

The Millard procedure is known as the rotation-advancement technique. It is a more flexible technique —cut-as-you-go— but needs more experience and artistry. The technique camouflages the violation of the philtrum column near the nose. With the Millard technique, one easily gets a vertical scar contracture with vermillion notching of the lip and a notorious tendency towards a small nostril. Excessive narrowing of the nostril is never far from reality and the surgeon simply should aim for a slightly larger nostril on the cleft side.

In most articles you will find that pre-surgical measurements are less important in the Millard procedure. But small mistakes in judgment, even by excellent surgeons, may quickly translate into irreversible cosmetic concerns. Therefore we think that measurements are equally important in the Millard technique as in the Tennison-Randall technique, at least to start with. The cut-as-you-go is a liberty reserved for refinement at the end of the operation.

The *advancement flap* is the flap on the cleft side (10-9-8). This advancement flap bridges the cleft and ultimately creates the cranial part of the philtrum. The *rotational flap* is enclosed by the curved line from (14) to (3) and a straight line back from (3) to (14). The *C-flap* (13-3-14) is used for the nostril sill. Correct repositioning of the orbicular muscle stays key. Success on the skin adjustment will not compensate for deficiencies in muscle redirection. The basket-weave method of muscle repair is an absolute guarantee for this.

THE MILLARD PROCEDURE FOR THE INCOMPLETE UNILATERAL CLEFT LIP CLOSURE

In incomplete clefts most of the time there is less overall distortion of the lip architecture, therefore it is easier to achieve a result close to 'perfection'. Most of the time the rotational incision is extensive, due to the shortness of the NC side. It should have the shape of a fish hook with the tip at landmark (14).

Illustration 40:

Landmarks and cutting design for the Millard procedure.

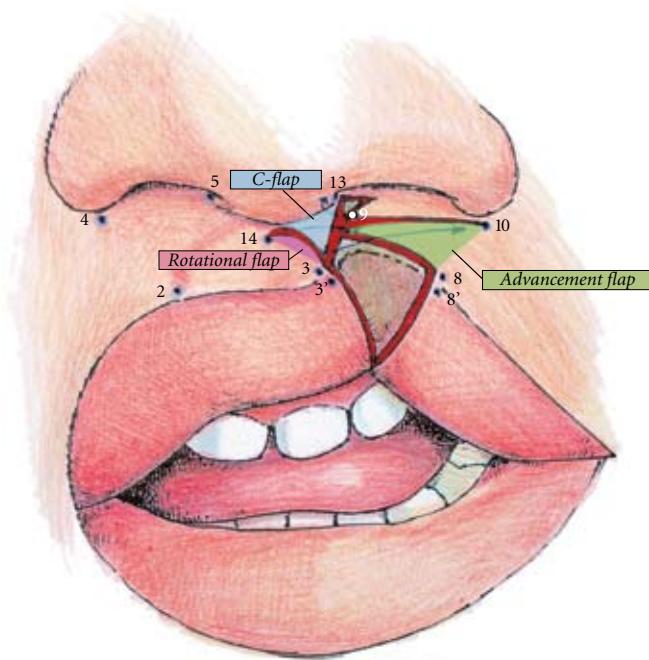
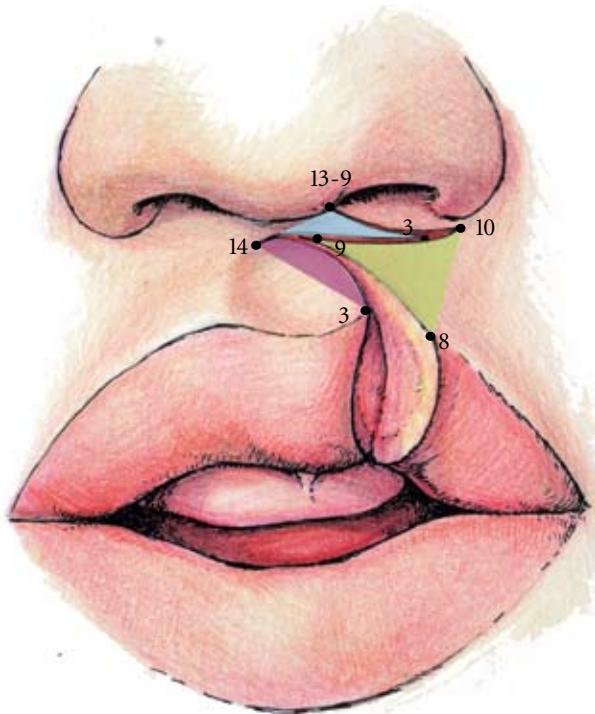


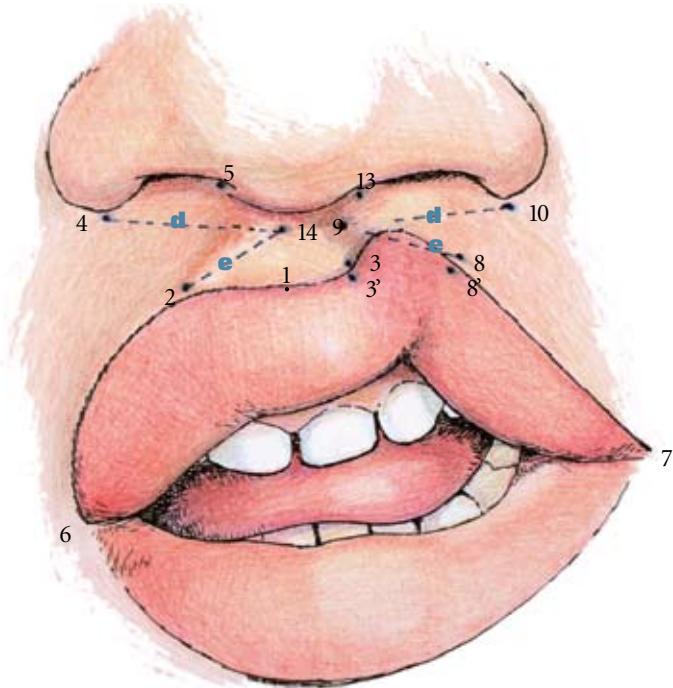
Illustration 41:

The Millard procedure just before the closing procedure.



LANDMARKS

Illustration 42:
Landmarks for the Millard
design.



NASAL LANDMARKS

Landmark 5 and 13 First mark the end of the medial crus of the lower lateral cartilage. This landmark is considered the columellar base. The German name for this landmark is famous: 'Naseneingangschwelle'. This is landmark (5) on the non-cleft side and landmark (13) on the cleft side.

Illustration 43:

Marking landmark 13, the end of the medial crus of the lower lateral cartilage.

**Landmark 4 and 10**

Mark the *alar bases* as landmarks (4) and (10). These landmarks are found at the end of the light reflection on the nostrils. It is most important that both landmarks are in a comparable position right to left, otherwise your measurements are meaningless.

These four landmarks are made close to the cartilage in order to allow for maximum rotation of the alar base.

VERMILLION BORDER LANDMARKS**Landmark 2, 3 and 1**

Landmark (2) is the top of the Cupid's bow on the healthy side and is easy to locate. Therefore it is tattooed right away.

Landmark (3) is the end of the white roll on the NCS, it represents the other end of the Cupid's bow. Landmark 3 is tattooed as well.

Landmark (1) is chosen as the middle of (2) and (3). It represents the middle of the Cupid's bow.

Landmark 8

On the lateral or cleft side (CS) of the cleft we still need to establish the peak of the Cupid's bow. This landmark (8) is again the end of the white roll on the lateral side.

The distance between the commissure on the non-cleft side and the Cupid's bow landmark (6)-(2) is measured and transferred to the cleft side just to check. Often the available distance (7)-(8) is shorter, but in partial clefts this is no rule (see note).



Note on landmark 8

The vertical distance from the alar base on the NCS to the peak of the normal Cupid's bow (4)-(2) must ultimately match the distance on the CS from its alar base to its peak bow (10)-(8). This distance by average is 10 mm and is measured with slight mesial-downward stretching. Point (8) once finally chosen should balance the vertical to the horizontal, bearing in mind that vertical discrepancy by far is more disturbing than horizontal discrepancy.

So point (8), the end of the white roll, is often located more lateral than horizontally measured, but then at least you have an idea how much, and, if this is a reasonable shortening. Reasonable is 1-2mm, otherwise we choose for the Tennison-Randall method.

Landmark 3' and 8'

On both sides of the cleft landmarks (3) and (8) are the paring peaks of the Cupid's bow and they are marked twice: One landmark is marked just above the white roll (3 and 8) and one landmark is perpendicular to the white roll just in the red lip (3' and 8'). The distance between both upper and lower landmarks is on average 1,5 mm. It is most important that this little distance is equal on both sides. These four cardinal landmarks should stay clearly visible during the whole surgery. Suturing these landmarks at the end of the procedure will create the new Cupid's bow top with a close to normal white roll, in a continuous mode and without steps.

LANDMARKS FOR THE ROTATIONAL AND ADVANCEMENT FLAP

Landmark 14

Landmark (14) represents the end of the rotational flap. This landmark is situated about 1 mm caudal to the columella-philtrum-border and in the middle of it.

Illustration 44:

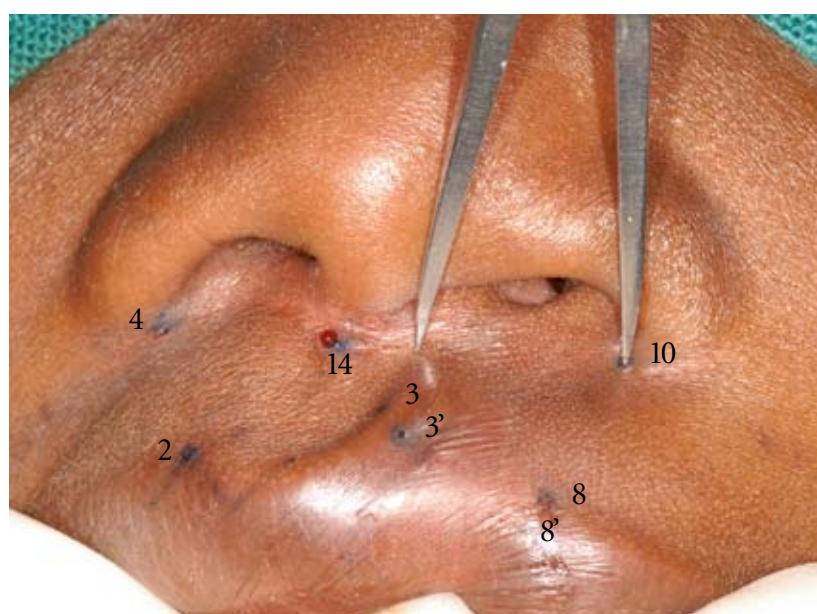
Landmark (14) 1 mm caudal of the columella-phil-trum border.

**Landmark 9**

Landmark (9) represents the tip of the advancement flap. To determine the position of landmark (9) you have to measure distance d (14 to 4) and distance e (14 to 2). These distances are transposed to the affected sides: distance d starting at landmark 10, distance e starting at landmark (8). Thus landmark (9) is found.

Illustration 45:

Determining the position of landmark 9 by transposing distance 14-4.



MUCOSAL TRIANGLE LANDMARKS

The next effort in design is dedicated to the symmetry and natural fullness of the mucosal part of the lip, with a symmetrical flowing of dry and wet tissues.

Wet-dry border

First, determine the wet-dry border. Mark these lines, on both sides, with the wooden stick dipped in methylene blue.



Practical tip

To find the wet-dry border: apply moderate pressure with the volar side of the index finger along the white roll of the lip. On the highest profile, CS and NCS, draw a line with methylene blue.

Illustration 46:

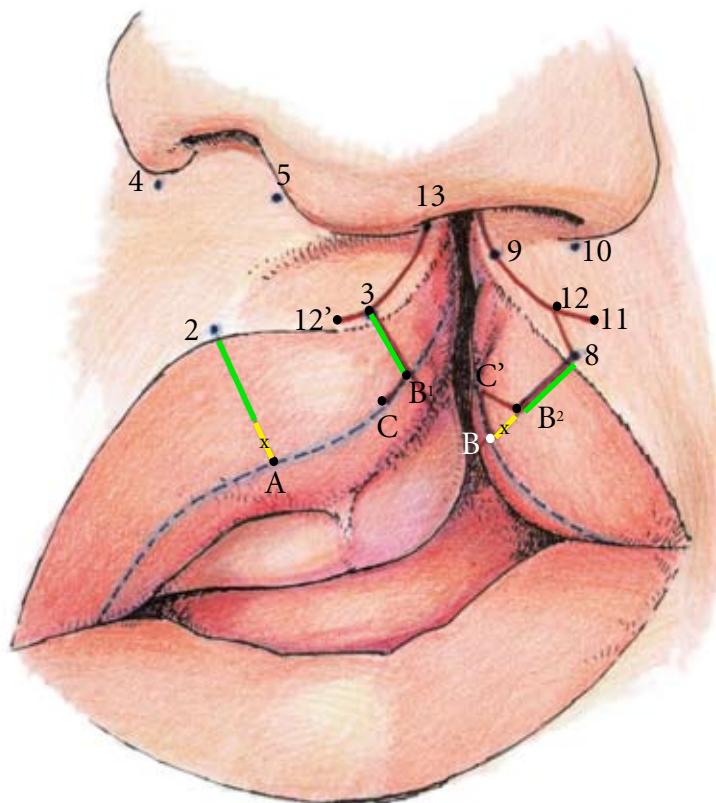
Marking of the wet-dry border.



The distance from landmark (2) to (A) should finally become the lipmucosa length on the side of the cleft too. Distance (3)-(B¹) is too small, compared to (2)-(A), therefore a triangular piece of mucosa is taken from the cleft side and is brought in via a deep incision to the opposite side. Since length (3)-(B¹) is 'x' shorter than (2)-(A), 'x' must be added to establish equal length.

Illustration 47:

Landmarks for the mucosal triangle (the illustration is from the Tennison-Randall procedure but the principal is the same for the Millard).

**Landmark A and B**

Measure the distance between landmark (2) and the wet-dry border in a perpendicular fashion. This distance (2)-(A) is the reference for the pair side (there is no need to tattoo landmark A). The same distance is measured on the CS lip from (8) to the wet-dry border. This is most often not done in a perpendicular way since the lip is often thinner near this side, so (B) is chosen more laterally on the CS lip. This landmark (B) is clearly indicated with a needle dipped in methylene blue.

Landmark B¹ and B²

Then measure the distance from landmark (3) perpendicular to the blue line, and tattoo landmark (B¹). Deduct this distance (3)-(B¹) from distance (8)-(B) to find landmark (B²).

Landmark C and C'

Choose landmark (C') on the wet dry border on the cleft side in such a way you create a more-or-less equally sided mucosal triangle.

Create landmark (C) on the wet-dry border on the non-cleft side, on such a distance from (B¹) that the mucosal triangle will nicely fit in—approximately the distance (B)-(B²).

Distance (B)-(B²) is the base of an equal-sided triangle, with one side of the triangle lying along the blue line. This full body mucosa-muscle triangle, after incision, will be brought in a deep incision from (B¹) to (C), thus splitting (B¹). Later, the upper half of (B¹) will be sutured to (B²), the lower half to (B). Landmark (C') will be sutured to (C). When this is done appropriately the lip comes close to symmetry and natural fullness.

INFILTRATION

Infiltration is started in the lip and nose with local anesthesia/adrenaline. To enlarge dimensions and prevent bleeding of the superior labial artery, pump the lips up quite firmly (2-3cc). For good vasoconstriction wait 5-10 minutes. Use this time to make your ‘cutting design’ by connecting the marking landmarks.

**Practical tip**

Enter the infiltration needle away from the design area, since even a bit of bleeding is annoying.

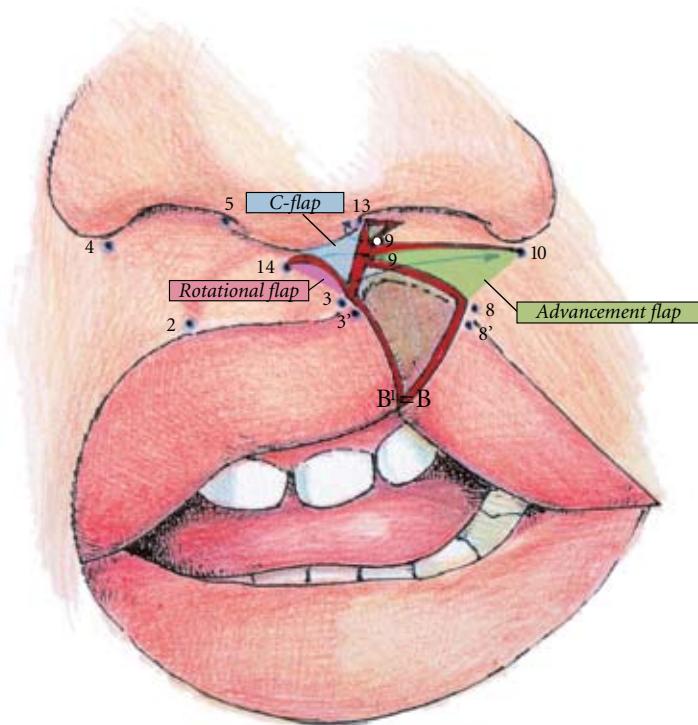
CUTTING DESIGN

The cutting design is made with methylene blue and the wooden stick. Connect most of the tattooed landmarks as shown in the illustrations. Pay attention and be conservative in the tissues you disregard, especially on the mucosa-skin borders.

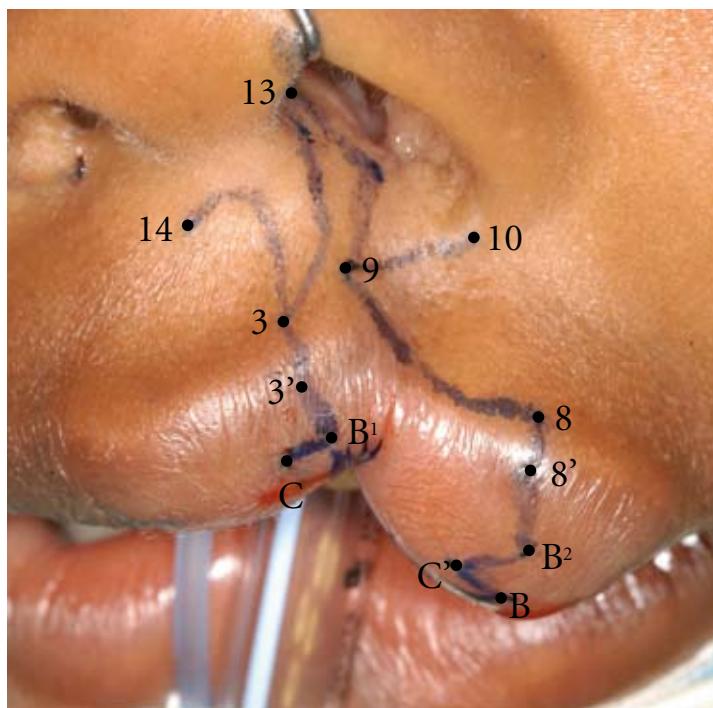
Illustration 48:

Cutting design and directions in which flaps should be transposed.

In this illustration the mucosal triangle is not made because the volumes of the red lip fit ($3-B^1 = 8-B$).

**Illustration 49:**

Picture of the cutting design. In this case the mucosal triangle was necessary.



Rotational flap

With the wood stick start drawing from landmark (3) towards landmark (14). Close to the columella base the drawing curves medially, clearly flirting with the columella-philtrum border, then it goes downward to the mid-landmark (14). Make sure the curve is wide enough (about 2 mm). It should look like a little fish bracket. A too narrow curve prohibits sufficient rotation of your rotation flap.

C flap

Near the columella, between the rotational flap and advancement flap is a no man's land of tissue and skin. Part of it is the C flap, the rest is some extra tissue, most of it mucosa. One limb of the C flap is constituted by the rotational incision, the other one by the line connecting landmark (13) and landmark (3).

The upper half of landmark (9) will be sutured to (13). To be able to do this a little dog ear triangle has to be excised. The C flap comes in between this little flap and the advancement flap helping to create the nostril sill. Sometimes you'll have to cut off the tip of the C flap because it's too long—this is part of the cut-as-you-go.

CUTTING

CUTTING OF THE MUCOSAL AND CUTANEOUS TISSUES

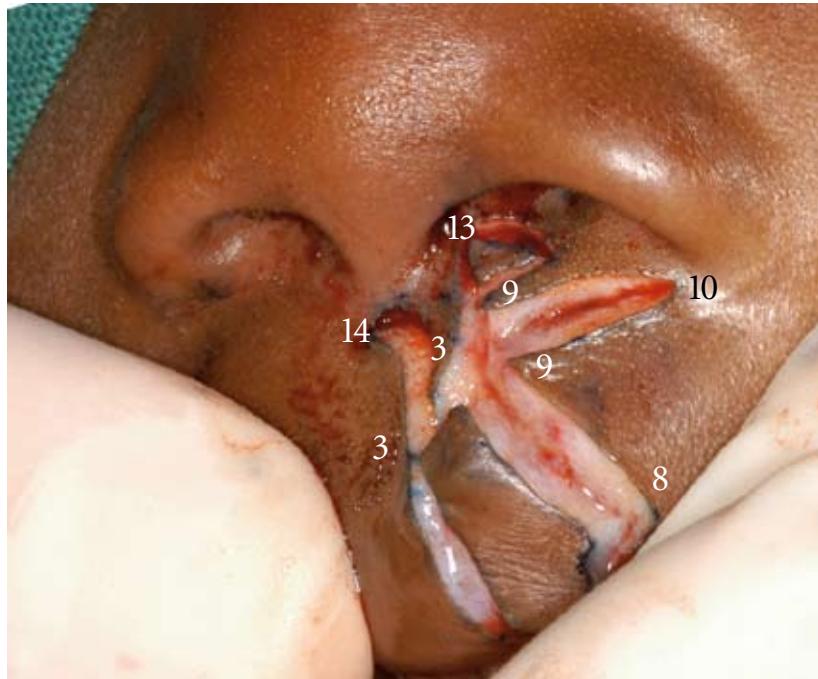
For the cutting procedure, use blade 11. Make no incision deeper than the submucosal or subcutaneous layer. This way there is no undue damage to the orbicular muscles. Remove the mucosal and cutaneous tissues in a conservative way. *Always have in mind your blue tattoo landmarks, and leave them in the not-to-be-removed part.*

Save as much tissue as possible. Use at least three fresh blades no. 11 for a single surgery, or combine the 11 blade with 15 blades.

When cutting the rotation flap make the curve wide enough and fluent. There should be no 'corners'.

Illustration 50:

Cutting procedure. The initial incision is no deeper than the submucosal or subcutaneous layer.



CUTTING FOR THE BASKET-WEAVE MUSCLE REPAIR

We believe the muscle interdigitating technique rests on a sound surgical basis and greatly helps to harmonize the lip structures where it is most stigmatizing: the muscular layer. Its promise, indeed, is to create an undisturbed functional and anatomical fair muscular unit around the 'once cleft' mouth.



Note

The technique is written down in the article of *M. Brent Seagle, M.D. and Leonard Furlow Jr., M.D.* in PLAST. RECONSTR. SURG. 113: 1537, 2004.

Start with a through and trough incision separating the orbicular muscle in a caudal muscle part belonging to the mucosal lip and a cranial muscle part belonging to the skin part of the lip. This is done importantly at the level of the white roll. For the moment we leave the caudal muscle part untouched.

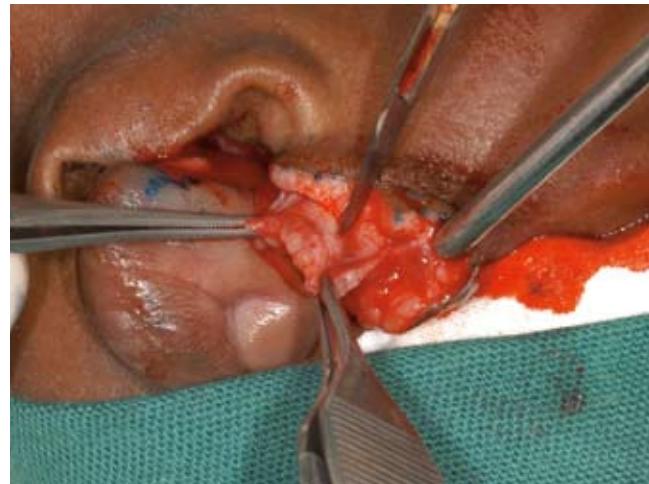
Dissect the cranial muscle part from the skin and the mucosa over a distance of 10 mm on the CS and 5 mm on the NCS. Do this in one cutting movement,

fixing the lip firmly between thumb and index finger. Take special attention to free the muscle completely from the nasal spine on the NCS and from the alar base near the CS. You can use a dental periosteal (molt no. 9) to achieve this to its full extent.

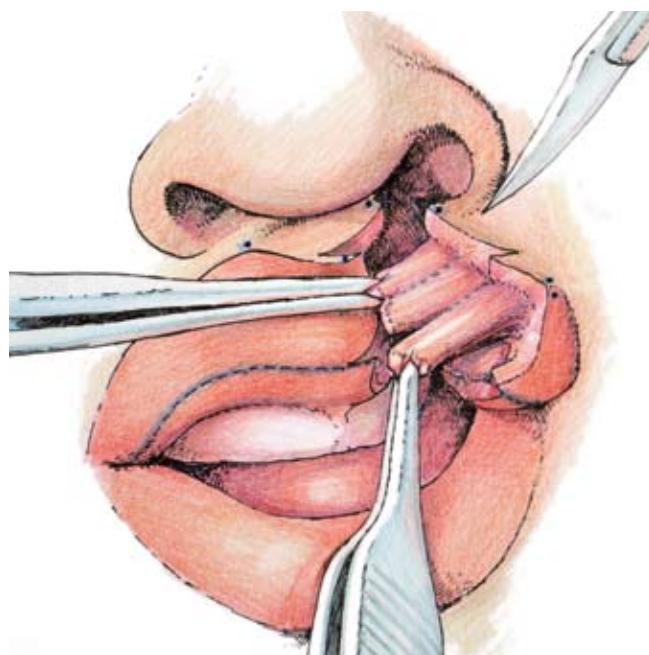
Cut the undermined cranial part of the muscle into 3 equal slices.

Illustration 51:

The cranial part of the orbicular muscle before it is cut (the illustration is from the Tennison-Randall procedure but the principle is the same for the Millard).

**Illustration 52:**

Cutting the orbicular muscle in three equal slices (the illustration is from the Tennison-Randall procedure but the principle is the same for the Millard).



UNDERMINING OF THE ALAR BASE AREA

Alar base area

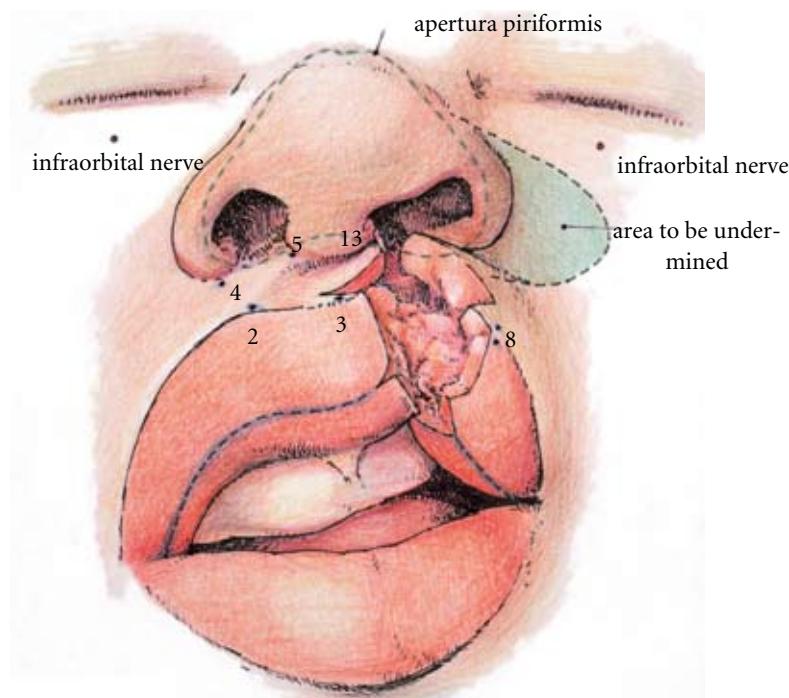
The alar base area can easily be reached from underneath the cranial muscle part. Release the alar pad from the alveolus with a pair of scissors and a molt no. 9. Elevate the soft tissues from the pyriform aperture in the supra-periosteal plane. Follow the pyriform aperture on the CS over the periosteum with a pair of scissors and undermine the cheek area until the cleft can be closed with no, or minimal, tension. Be careful not to damage the infraorbital nerve. Protect the nerve by putting your index finger on the infraorbital foramen.

In partial cleft lips this undermining should not be too extensive. Adequate undermining means that the advancement flap can be moved into the rotational gap with no tension. This should be checked with a single hook on landmark (8) and (3) to pull landmark (3) up, thus opening the space that should receive the advancement flap. This should bring both sides together without tension.

Illustration 53:

Undermining the alar base area.

(The illustration is from a Tennison procedure but the principle is the same for the Millard.)



Lower lateral cartilage At this moment you might free the lower lateral cartilage on the affected side from the overlying skin with a blunt curved pair of scissors. If you do this, at the end of the operation you should exorotate the lower lateral cartilage and fixate it to the skin using mattress sutures. We tend not to do this in small babies because it causes unnecessary damage to the cartilage. We prefer to do a secondary rhinoplasty at a later stage.

SUTURING

TRY-IN OF THE SUTURE FOR THE ALAR BASE POSITIONING

Position the alar base using a vicryl 5-0. This suture is important for two reasons. It levels both nostrils on the same height and it determines the width of the nostril. Pick up the areolar tissue directly under the alar base (10), with the PDS needle and come out exactly underneath landmark (9). Stay in the tissue, don't come out through the skin. Then pass the needle through the columellar base (13). Come out through the skin at its homologue landmark (5). Return from landmark (5), but in a slightly different direction in order to have some tissue in the loop.

Illustration 54:

Try-in suture for the alar base positioning.

(The illustration is from a Tennison-Randall procedure but the principle is the same for the Millard.)

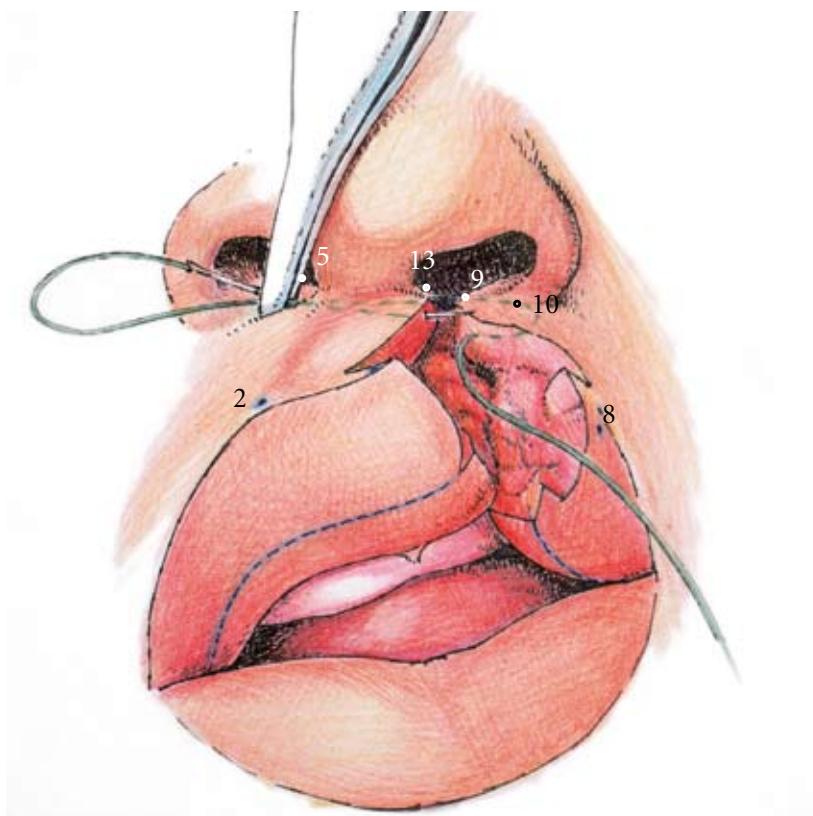
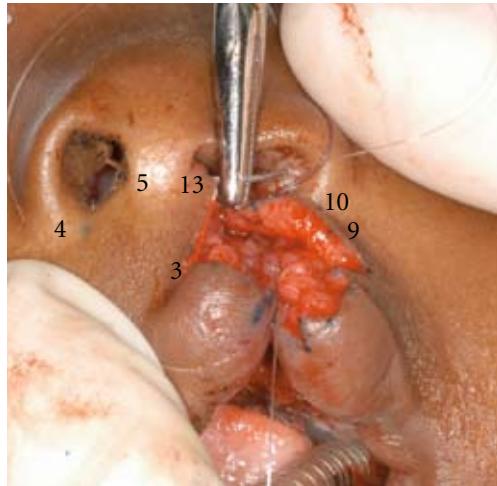


Illustration 55:
Passing the needle through
the columellar base.



Now examine the result by temporarily tying the suture. This is the moment to accept or possibly redo the suture by carefully examining the 3-dimensional position of the alar base on the affected side (in the axial plane and the coronal plane).

Illustration 56:
Examining the position of
the alar base after tempo-
rarily tying the suture.



If the suture seems fine, re-open the knot and attach a mosquito clamp to both ends of the suture.

The knot is to be finished at a later stage of the surgery, after the oral vestibule and the floor of the nose are sutured, otherwise access to the oral vestibule and floor of the nose will become difficult.

VESTIBULAR SUTURING

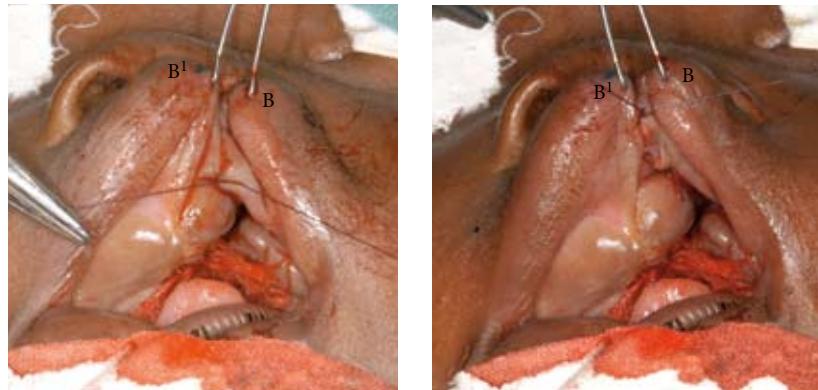
In partial clefts there is too much mucosa on the inside of the lip so you'll have to excise some of it, creating a V-shape with legs of equal length. Close the defect using a vicryl 5-0 stit.



Practical tip

Place a sharp double toothed retractor on the wet-dry-border (landmark B and B¹) and suture the inside from the vestibule to this border.

Illustration 57:
The suturing of the mucosal part of the lip.



NASAL FLOOR SUTURING

In partial clefts the floor of the nose is always too wide and a wedge of tissue needs to be excised. Close the wedge by suturing landmark (9) to (13).

ALAR BASE SUTURING

Now is the moment to make the knot in the previously placed suture of the alar base.

BASKET-WEAVE MUSCLE SUTURING

In order to give the lip a more natural dynamic, as during whistling, we will attach the muscular slings to the subdermal layer as it is at the normal side.

To suture the cranial muscle layer, draw two vertical lines on the non-affected side to show where the muscle slings are attached to the skin. You can see where the muscles are attached to the skin. Mirror these two vertical lines to the affected side. The muscle slings from the CS are sutured against the subdermal layer on the NCS in three levels and vice versa. To mark these three levels divide the two lines on the affected side in equal parts.

The suturing of the muscle slings is carried out using maxon 5-0 (resorbable mono filament). Pick-up the upper muscle sling from the CS, go through the skin of the NCS in one direction, and come back through the same hole but in a different direction, in order to have some subcutaneous tissue inside your loop. Now pick up the upper muscle sling from the NCS and attach it in a similar way to the opposite site.

Repeat the same procedure for the middle and lower muscle slings.

CAUDAL MUSCLE LAYER SUTURING

After having sutured all six muscle slings, suture the caudal muscle layer belonging to the red part of the lip.

Do this with a vicryl 4-0 stitch going through the cranial part of the muscle parallel to and just below the white roll, with the knot on the deep side. This should bring the Cupid's bow and white roll in an exact pleasing position. Landmark (3) and (8) should come close together, as well as (3') and (8'). If not, reconsider the stitch. There is no need to tighten the knot firmly, since this can disturb the flow of the skin suturing.

Illustration 58:

Suturing the caudal muscle layer belong to the red part of the lip.



FINAL CLOSURE SUTURING

Incision mucosal triangle

To receive the *mucosal triangle*, make an incision from (B) to (C). This incision is always along the wet-dry border.

Subcutaneous sutures

Now use vicryl 5-0 subcutaneous sutures to bring the skin flaps into their correct positions. Start with a subcutaneous suture at the *Cupid's bow* landmark (3) and (8).

Also place a subcutaneous suture under the tip of the *C-flap* and the *advancement flap*. Making both of these subcutaneous stitches should give you a sensation of relief and joy, as the wound edges over the whole line fall naturally and fluently.

Illustration 59:

Suturing the tip of the advancement flap.



Back cut

If you see that landmark (3) is still being pulled up because the rotation flap is too short you can lengthen it by making a very small back cut starting at marking point (14) coming vertically downward. If you go laterally this will influence the width of the nostril. Keep in mind that a back cut of 0.5 mm will lengthen the rotation flap by 1 mm.

Skin suturing

Suture the skin with catgut 6-0. If you have the opportunity to remove the sutures after 5 or 6 days, you might prefer to use nylon 6-0.

Mucosal triangle

Suture the mucosal triangle with vicryl 5-0 into the opening in the wet-dry border. Finish by suturing the rest of the mucosal lip.

Illustration 60:

A nice result.

The invagination points are due to the basket-weave technique. They fade away in a week time.

**SILASTIC SHEET SUTURING**

You could suture a little roll of silastic sheet into the operated nostril and fix it to the septum with a PDS mattress suture. Leave it in place until the PDS has resorbed and the sheet comes out by itself. The sheet will support the lower lateral cartilage to obtain a more rounded nostril.

PART 4

Bilateral Millard procedure

In our opinion this is the easiest of the three procedures described in this booklet. It's not very difficult to get symmetry and it's a very straightforward procedure.

The result of the operation will be an upper lip that is small in width compared to the lower lip. With growth, however, this will improve. Another problem is the very short or even absent columella. This is a problem that is preferably solved at a much later stage. Dimensions in these babies are so small that one can easily cause unnecessary damage by performing more extensive procedures at this time. Babies make uglier scars than grown-ups and the scarring will inhibit growth. A Millard forked flap at the age of 16 might be a good solution.

Illustration 61:
Landmarks and cutting design for the bilateral Millard procedure.

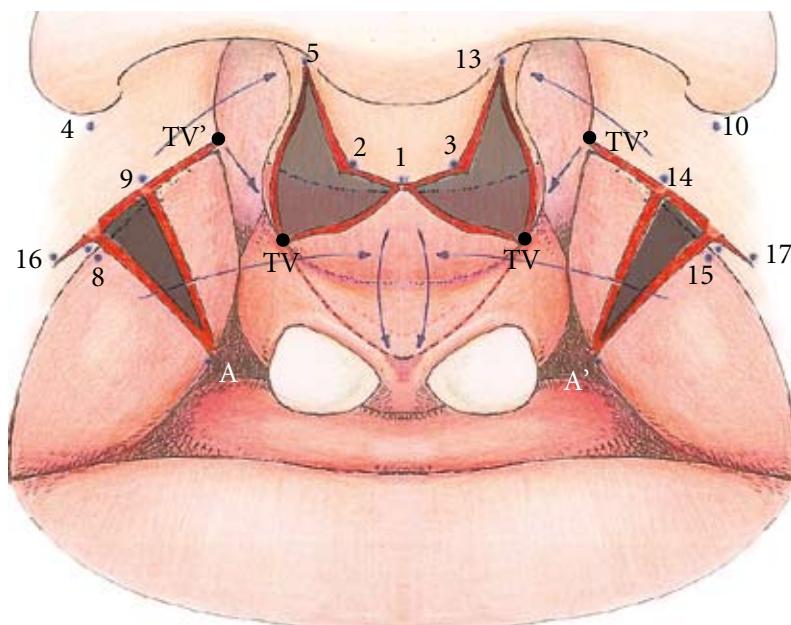


Illustration 62:
Millard procedure after
cutting.

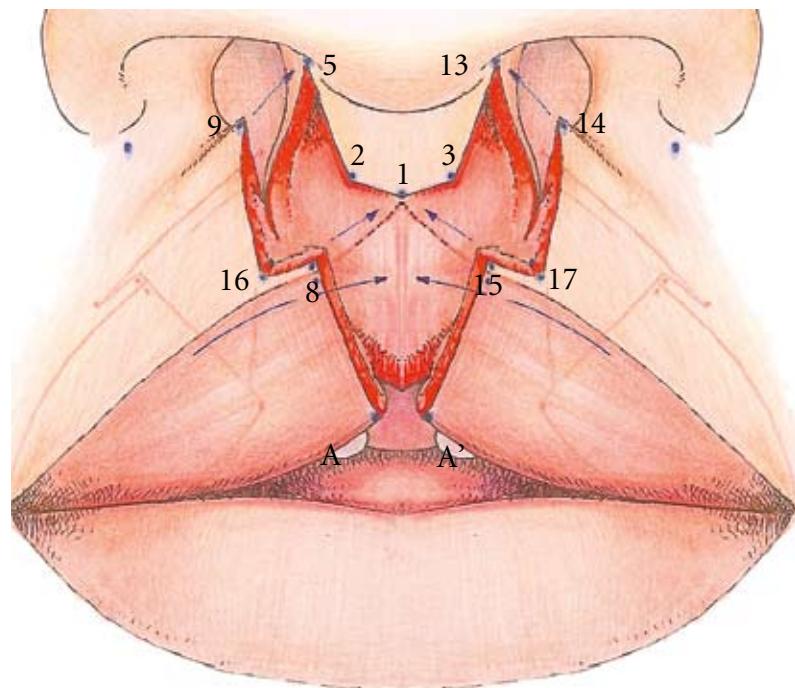
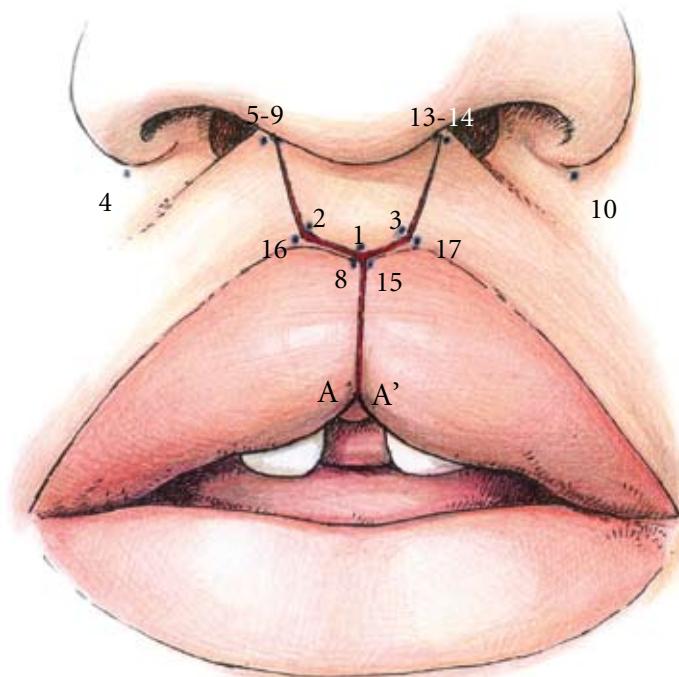


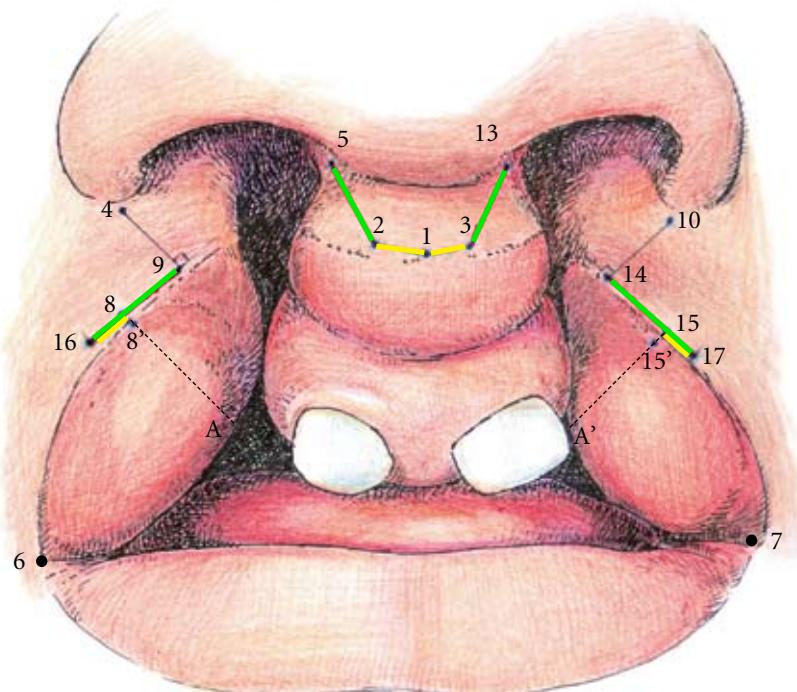
Illustration 63:
Millard procedure just be-
fore closure of the skin and
mucosa.



LANDMARKS

Illustration 64:

Landmarks for the bilateral cleft lip closure according to Millard.



NASAL LANDMARKS

Landmark 5 and 13 Mark first the end of the medial crus of the lower lateral cartilages on both sides. These landmarks, (5) and (13), are considered as the base of the columella. The German name for these landmarks is famous: ‘Naseneingangschwelle’.

Landmark 4 and 10 Mark the alar bases (4) and (10). They are found at the end of the light reflection on the nostrils. Those four landmarks are made close to the cartilage in order to allow for maximum rotation of the alar bases. Otherwise the lower lateral cartilages will remain flattened and the nostrils widened.

VERMILLION BORDER LANDMARKS***Landmark 1, 2, 3***

Mark philtrum middle (1) just at the border between white and red part of the lip. As the philtrum should be no wider than 4 mm you choose philtrum right and left (2) and (3) two mm on both sides next to (1). These last landmarks should be just above the border between the white and red part of the lip. The white roll will be brought in from aside under the philtrum.

Landmark 8, 8' and 15, 15'

Landmarks (8) and (15) are the end of the white roll at the lateral sides of the clefts. They are marked twice: one landmark is marked just above the white roll and one landmark is perpendicular under the white roll in the red lip. This enables you to cut the white roll in a perpendicular fashion. The distance between both upper and lower landmark is on average 1,5 mm. Most important is that this little distance is equal on both sides.

These four cardinal landmarks should stay clearly visible during the whole surgery. Suturing those landmarks at the end of the procedure will create the new white roll under the philtrum, in a continuous mode and without steps. Moreover these landmarks should end up at the same vertical height.

Landmark 16 and 17

2 mm laterally from landmarks (8) and (15) a landmark is chosen (16) and (17) that at the end of the surgery will be sutured towards (2) and (3).

Landmark 9 and 14

Now the length of the philtrum (5) – (2) is measured and transferred to the lateral side of the cleft starting from landmark (16). There landmark (9) is located just inside the skin along the border between white and red part of the lip. This landmark (9) is to be sutured later on towards (5). Repeat the same procedure on the other side to find landmark (14).

MUCOSAL TRIANGLE LANDMARKS

The next effort in design is dedicated to the symmetry and natural fullness of the mucosal part of the lip, with a symmetrical flowing of dry and wet tissues.

Wet-dry border

First, determine the wet-dry border. Mark these lines, on both sides, with the wooden stick dipped in methylene blue.



Practical tip

To find the wet-dry border: apply moderate pressure with the volar side of the index finger along the white roll of the lip. On the highest profile on both sides draw a line with methylene blue.

Illustration 65:

Determining and marking of the wet-dry border.



Landmark A and A'

Looking down from landmarks (8) and (15) choose the landmarks (A) and (A') on the wet-dry border in such fashion that the volume of the red part of the lip doesn't diminish towards the middle, thus avoiding a whistling deformity.

Illustration 66:

Measuring and tattooing of landmarks A and A'.

**VESTIBULAR LANDMARKS**

Landmark TV and TV' These landmarks represent the top of the oral vestibule on both sides of the cleft.

INFILTRATION

Infiltration is started in the lip and nose with local anesthesia/adrenaline. To enlarge dimensions and prevent bleeding of the superior labial artery, pump the lips up quite firmly (2-3cc). For good vasoconstriction wait 5-10 minutes. Use this time to make your 'cutting design' by connecting the marking landmarks.

**Practical tip**

Enter the infiltration needle away from the design area, since even a bit of bleeding is annoying.

CUTTING DESIGN**Illustration 67:**

The cutting line design and directions in which flaps will be transposed.

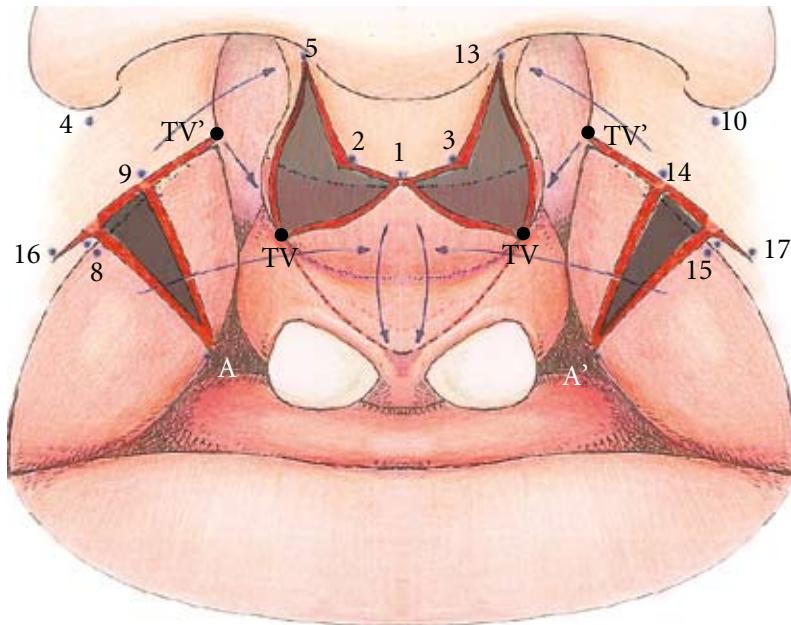
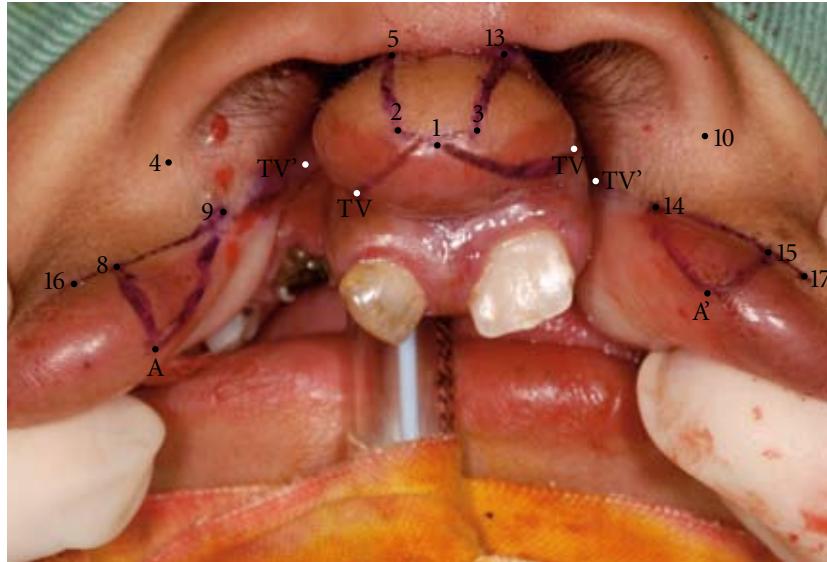


Illustration 68:
Picture of the cutting de-sign.

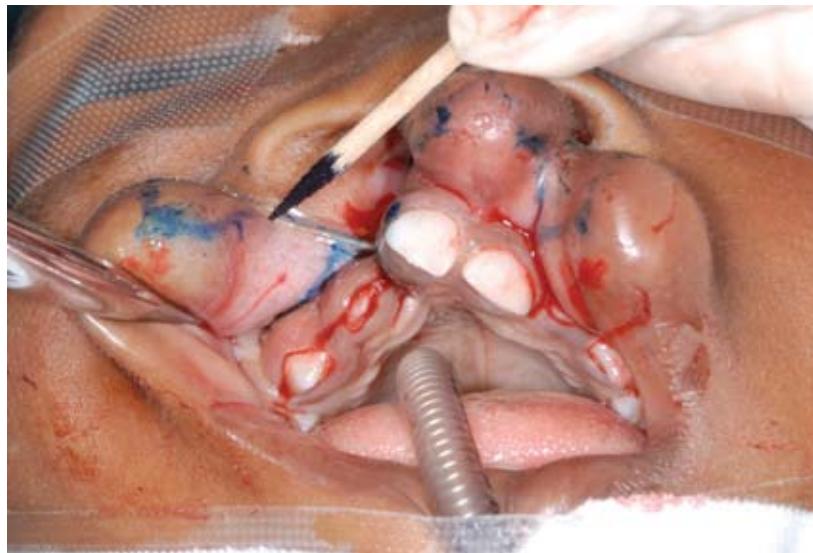


Muco-philtral design Connect all the tattooed landmarks we discussed above. Pay attention to be conservative in the tissues you disregard, especially on the mucosa-skin borders.

Muco-nasal design Now we still need to draw the mucosal design inside the mucosal cleft lip and nose. Start the design in the anterior part of the nose on the medial sides. Draw a line from landmark (5) to the top of the oral vestibule TV. For this, follow the border of the nasal skin and the nasal mucosa, distinctive in color and texture, towards the oral vestibule.

The oral side of the incision is continued towards landmark (1). On the lateral side, from landmark (9) continue the incision deeper in the nose along the border of the nasal skin and the nasal-oral mucosa to (TV'). Repeat the drawing on the other side of the cleft.

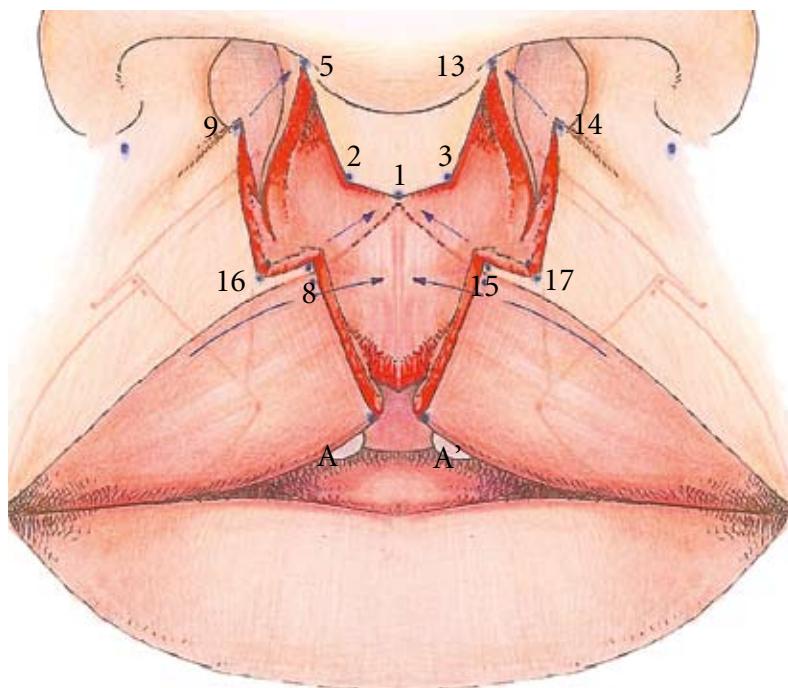
Illustration 69:
Muco-nasal design. Continuing of the incision from (9) to (TV').



CUTTING

CUTTING OF THE MUCOSAL AND CUTANEOUS TISSUES

Illustration 70:
Cutting of the mucosal and cutaneous tissues.



For the cutting procedure, use blade 11. Make no incision deeper than the submucosal or subcutaneous layer. This way there is no undue damage to the orbicular muscles. Remove the mucosal and cutaneous tissues in a conservative way. *Always have in mind your blue tattoo landmarks, and leave them in the not-to-be-removed part.*

Save as much tissue as possible. Use at least three fresh blades no. 11 for a single surgery, or combine the 11 blade with 15 blades.

CUTTING FOR THE BASKET-WEAVE MUSCLE REPAIR

We believe the muscle interdigitating technique rests on a sound surgical basis and greatly helps to harmonize the lip structures where it is most stigmatizing: the muscular layer. Its promise, indeed, is to create an undisturbed functional and anatomical fair muscular unit around the 'once cleft' mouth.



Note

The technique is written down in the article of *M. Brent Seagle, M.D. and Leonard Furlow Jr., M.D.* in PLAST. RECONSTR. SURG. 113: 1537, 2004.

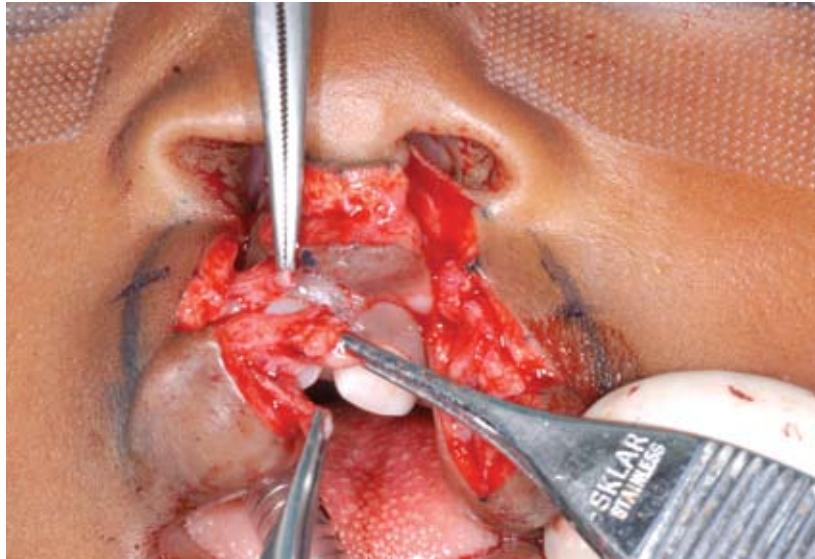
Start with a through and trough incision separating the orbicular muscle in a caudal muscle part belonging to the mucosal lip and a cranial muscle part belonging to the skin part of the lip. This is done importantly at the level of the white roll. For the moment we leave the caudal muscle part untouched.

Dissect the cranial muscle part from the skin and the mucosa over a distance of 10 mm (10 mm laterally, medially there is no muscle). In the cleft philtrum there is no muscular layer present. So the muscle has to come from the lateral sides. Do this in one cutting movement, fixing the lip firmly between thumb and index finger.

Cut the undermined cranial part of the muscle into 3 equal slices.

Illustration 71:

Cutting the cranial part of the muscle in 3 equal slices.

**UNDERMINING OF THE ALAR BASE AREA**

Now undermine the alar base area of the nose on both sides. Follow the pyriform aperture over the periosteum with a pair of scissors and undermine the cheek area till the cleft can be closed with no or minimal tension. Be careful not to damage the infraorbital nerve.

SUTURING

TRY-IN OF THE SUTURE FOR THE ALAR BASE POSITIONING

Position the alar base using a PDS 4-0 or 5-0. This suture is important for two reasons. It levels both nostrils on the same height and it determines the width of the nostril.

Pick up the areolar tissue directly under the alar base (landmark 10) with the PDS needle and come out exactly at landmark (14). Then pass the needle through landmark (13). Come out at marking point (5) on the other side and pick up the areolar tissue under the second alar base (4) and come out at (9). Return through the philtrum entering at (5) and coming out at (13).

Now examine the result by temporarily tying the suture. This is the moment to accept or possibly redo the suture by carefully examining the 3-dimensional position of the alar bases.

If the suture seems fine, re-open the knot and attach a mosquito clamp to both ends of the suture.

The knot is to be finished at a later stage of the surgery, after the oral vestibule and the floor of the nose are sutured, otherwise access to the oral vestibule and floor of the nose will become difficult.

VESTIBULAR SUTURING

Start first to dissect the vestibule of the mouth. The mucosa in the vestibule on the lateral side of the cleft most often needs to be incised and mobilized in order to suture in continuity to the mucosa of the cleft side and across the cleft gap. This is done to the top of the vestibule on the non-cleft side. Start with 2 or 3 intermediate sutures using vicryl 5-0 or polysorb 5-0, each time half way in order to divide the tension.

Illustration 72:
*Vestibular incision in order
to be able to suture TV to
TV'.*

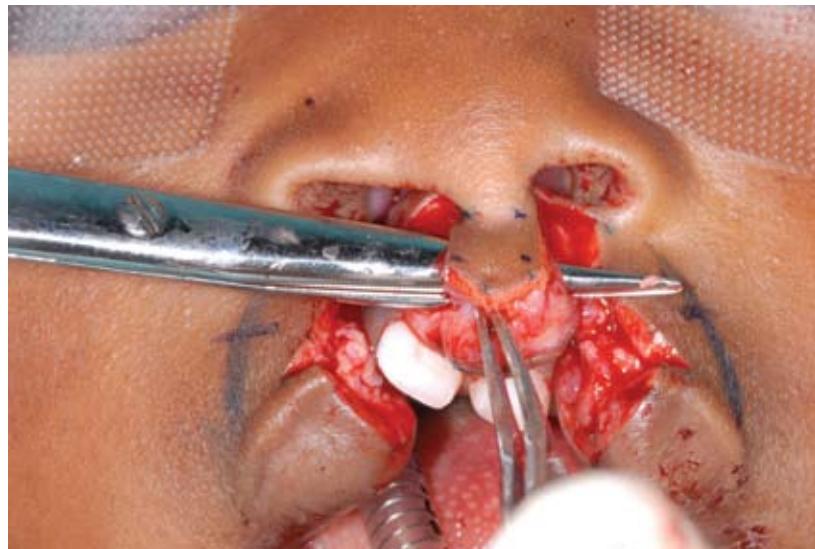
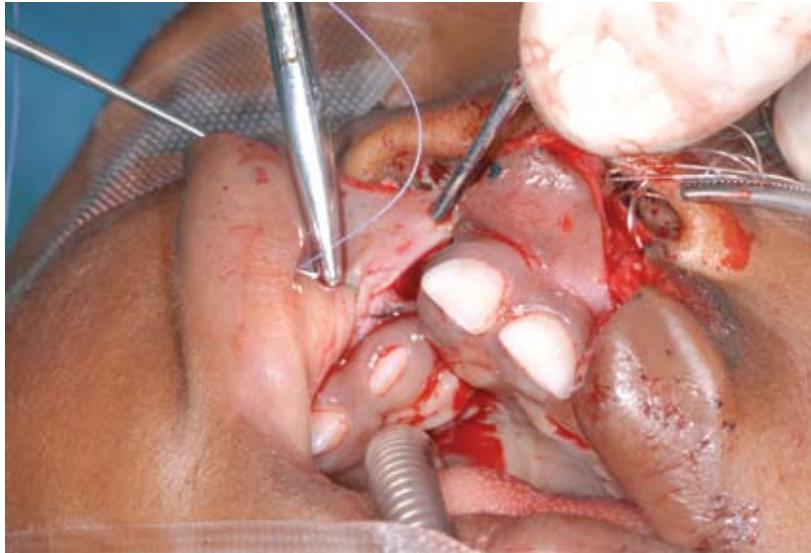


Illustration 73:

Intermediate suture to divide the tension to finally suture TV to TV'.



Then continue the suturing of the mucosal part of the lip along the cleft, up to the wet-dry border (landmark A and A').

**Practical tip**

Place a sharp double toothed retractor on the wet-dry-border (point A and A') and suture the inside from the vestibule to this border .

NASAL FLOOR SUTURING

The suturing of the anterior floor of the nose starts from posterior to anterior. Suture landmark (TV) on the lateral side of the cleft to (TV) on the medial side and divide the rest of the distance up to landmark (9) to landmark (5) in 2 or 3 stitches. Do the same on the other side.

ALAR BASE SUTURING

Now is the moment to make the knot in the previously placed suture of the alar base.

BASKET-WEAVE MUSCLE SUTURING

Now the muscle slings have to be sutured to the skin in such a way that you create a more natural appearance of the lip during whistling.

Vertical lines (laterally) and dots (inside the philtrum) are being placed to show where the muscle slings should be attached to the skin.

Illustration 74:

Vertical lines and dots are placed to show where the muscle slings should be attached to the skin.

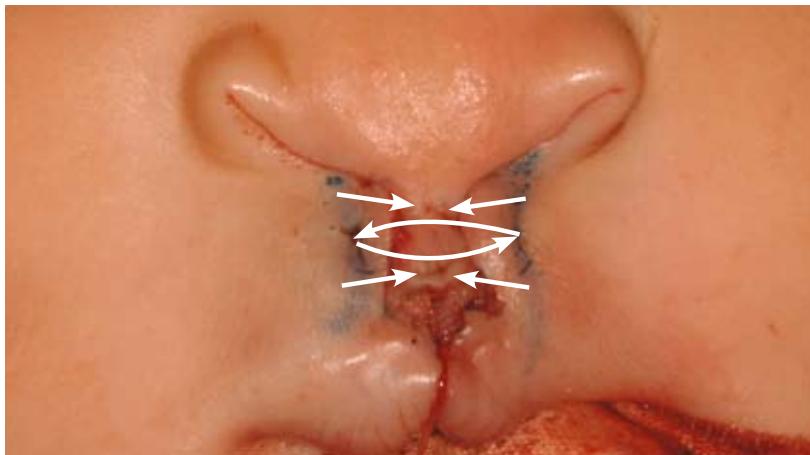


Suturing the muscle slings are carried out using maxon 5-0 (resorbable monofilament). Pick up the muscle sling, go through the skin in one direction, and come back through the same hole but in a different direction, in order to have some subcutaneous tissue inside your loop.

The middle muscle sling on the right side passes through the philtrum and is being sutured to the skin on the lateral side of the cleft on the left side and vice versa. The upper and lower slings on the right side are being sutured to the lateral skin of the philtrum. Same on the left side.

Illustration 75:

Suturing pattern for the bilateral cleft.

**Illustration 76:**

Hole made to pass the middle muscle slings through the philtrum.

**Illustration 77:**

Passing the middle muscle sling through the philtrum.



CAUDAL MUSCLE LAYER SUTURING

After having sutured all 6 muscle slings, finish the caudal muscle layer belonging to the red part of the lip. You do this with a vicryl stitch going through the cranial part of red muscle part parallel to and just below the white roll, with the knot on the deep side. Check if the white roll is more-or-less continuous.

FINAL CLOSURE SUTURING

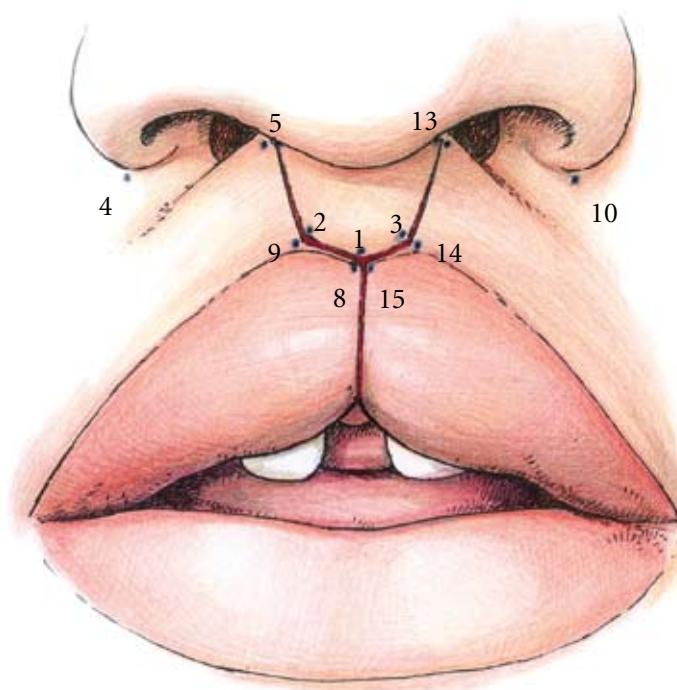
Subcutaneous Now use, as needed, some vicryl 5-0 subcutaneous sutures to bring the skin into its correct position.

Cutaneous Finish by suturing the skin with catgut 6-0. If you have the opportunity to remove the sutures after 5-7 days, you might prefer to use nylon 6-0.

First, suture the Cupid's bow highest landmarks to their corresponding match (2-9 and 3-14).

Illustration 78:

Bilateral cleft after complete closure.

**Illustration 79:**

A patient after surgery. Notice the relatively narrow width of the upper lip and the short columella and philtrum.



SILASTIC SHEET SUTURING

You could suture a little roll of silastic sheet into the operated nostril and fix it to the septum with a PDS mattress suture. Leave it in place until the PDS has resorbed and the sheet comes out by itself. The sheet will support the lower lateral cartilage to obtain a more rounded nostril.

About the instruments

Good instruments are important.



Titamed, in cooperation with Joel Defrancq, made a handy box (Titamed, Belgium, www.titamed.com) containing 2 Adson pincets, a Castroviejo caliper, 3 towel clamps, a lancet, a molt, a single and a double-toothed sharp retractor, a needle holder, a mosquito, a fine and a bigger curved blunt pair of scissors and a suction canule. Each instrument has its own place in the box and is protected by Teflon. The box with instruments weights 2 kilograms.

Illustration 80:

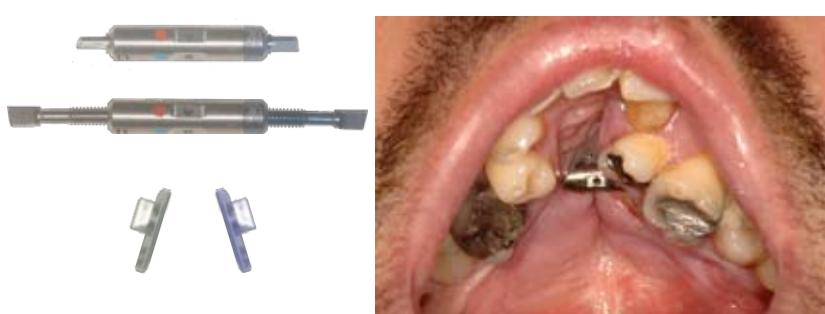
Handy instrument box from Titamed.



In 2005 Titamed designed a new surgically-assisted rapid palatal distractor, the Smile Distractor. This palatal distractor can be very useful for cleft lip patients because the modules come in very small sizes. Patient information and case studies can be found on their website: www.titamed.com.

Illustration 81:

Palatal distractor.



About the authors

BART VAN DE VEN (born in Heerlen, the Netherlands), founded the *Cleftsurgery Organization* in 2001 (www.cleftsurgery.org). Together with Dr. Frans Noorman van der Dussen from the *Eeuwfeestkliniek* in Antwerp, Belgium, he has been to Kenya several times to operate on cleft lip and palate patients.

In March 2008 Bart van de Ven and Daniel Simon (from Sao Paulo, Brasil), opened the *Agave Clinic, International Centre for Advanced Maxillofacial Surgery* in Marbella, Spain.

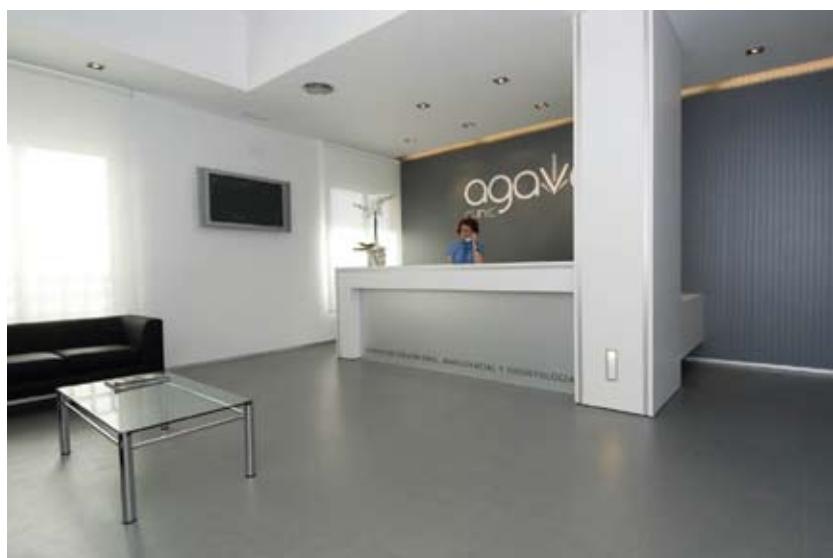
In 2003 JOEL DEFRENCQ, also from the *Eeuwfeestkliniek* in Antwerp joined Bart van de Ven on his missions abroad. Joel Defrancq is a maxillofacial surgeon, trained in Leuven (Belgium), Arnhem (the Netherlands) and at the University of Washington (USA). He has practiced maxillofacial surgery in Antwerp (Belgium) in the *Eeuwfeestkliniek* (Monica-group) since 1982, and is involved in a professional association with six other maxillofacial surgeons. His associates, Dr. Noorman van der Dussen and Dr. Nasser Nadjmi, introduced him to the fascinating world of cleft surgery, and in 2003 he became a member of the *European Cleft Lip and Palate Foundation* (www.eclpf.org). The foundation is dedicated to the generation of funds to enable us to perform missions abroad with other colleagues. The average cost of one operation in developing countries is between €80 and €100.



Over the last few years Bart van de Ven and Joel Defrancq have operated on several hundreds of patients in Kenya, Vietnam, Myanmar (Burma) and Nepal.



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- **Correction of cleft lip and palate:**
We treat congenital malformations of the lip, maxilla and palate.
- **Oral surgery:**
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- **Reconstructive implantology:**
 - Technology, high level dentistry and surgical experience can reduce treatment time, allowing us to place implants and teeth on the same day.
 - 3D computer surgical planning for an accurate placement of the dental implants.
 - Reconstruction of the maxillary bone (grafts).
- **Orthognathic surgery:**
Surgical correction of dentofacial deformities.
- **Facial aesthetic surgery:**
Blepharoplasties (upper and lower eyelid surgery), rhinoplasties (nose reconstruction), otoplasties (ear surgery), face- and necklifts, injectables and chemical peelings.
- **Facial feminization surgery:**
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- **Facial traumatology:**
We diagnose and treat fractures of the teeth and facial skeleton.
- **Dentistry:**
Advanced treatments, treatments using intravenous sedation or general anesthesia and orthodontics.



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