Unilateral cleft lip and palate: Simultaneous early repair of the nose, anterior palate and lip

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Unilateral cleft lip and palate is a defect involving the lip, nose and maxilla. These structures are inter-related, and simultaneous early correction of all the aspects of the defect is necessary to obtain a satisfactory result that will be maintained with growth. The surgical technique combining various procedures is presented and compared with previously published reports.

Key Words: *Cheiloplasty; Cleft lip; Cleft nasal deformity; Cleft nose; Primary palate; Unilateral cleft lip repair*

Unilateral cleft lip and palate is much more than an anomaly of the lip and palate; it is a defect of the middle one-third of the face. In treating this deformity, it is essential to address the different elements of the problem: the bony defect of the maxilla, the nasal deformity and the dynamic force of the lip, the muscle, which is responsible for much of the distortion of the nose and maxilla. We also have to keep in mind that the orbicularis muscle has a very significant effect on the growth of the maxilla. Muscular reconstruction is key to balancing the forces acting on the maxilla, the nasal tip and the lip. The lip has to be symmetrical not only at rest, but also on animation, and it has to grow symmetrically. We are indebted to the work of numerous surgeons, and the technique described below brings together knowledge gathered over many years, emphasizing a one-unit concept.

UNDERSTANDING THE CLEFT ANATOMY

The maxilla is widely 'open' at the level of the pyriform aperture. Medially, the premaxilla is pulled toward the normal side, together with the nasal septum, columella and nasal spine. The medial alveolar bone is also rotated superiorly. The tongue, being elevated in the cleft, can also play a role in widening the defect. Laterally, the maxilla and the base of the nostril are pulled away from the midline, and the lower lateral cartilage is displaced inferiorly (1,2). The maxilla is also often displaced superiorly and a certain degree of retrusion can be observed. The lower turbinate can sometimes be interposed between the edges of the cleft maxilla. The orbicularis oris, instead of having a normal insertion in the medial lip element, is attached laterally, exerting lateral and superior traction on the base of the nostril and the pyriform aperture (3-6). It is very interesting to observe the contraction of the orbicularis on an unrepaired cleft and see the widening of the nostril as the patient

Fente labiopalatine unilatérale: correction primaire simultanée du nez, du palais primaire et de la lèvre

Les fentes labio-palatines sont des déformations qui intéressent la lèvre, le nez et le maxillaire. Ces structures sont inter reliées et une correction précoce simultanée de tous les aspects de la déformation sont essentiels pour obtenir un résultat satisfaisant qui sera maintenu avec la croissance. Une technique chirurgicale qui intègre différentes interventions est présentée et comparée avec les techniques couramment utilisées.

smiles. It makes it easier to understand how the abnormal muscular insertions have to be completely released from the nose and maxilla before the muscular repair can be achieved effectively (7,8).

Closing the cleft maxillary defect from the incisor foramen, along the floor of the nose and reaching the labial sulcus allows the surgeon to build a stable base to adjust the lip. Placing the affected alar cartilage symmetrical to the normal side also has to be done before lip closure – before the columella and nostril base are brought together – because they are interdependent structures. Furthermore, if the lowered nasal tip is corrected secondarily, elevation of the nasal tip may pull the lip superiorly and shorten it. Finally, during the muscular reconstruction, the lateral orbicularis is used to centralize the columella and lengthen the central segment.

SURGICAL TECHNIQUE

Medial unit dissection

Many skin incisions have been proposed over the years; they all have advantages and disadvantages. The rationale is that they should allow for preservation of the Cupid's bow, provide symmetry of the two sides of the lip and leave as little scar as possible. Every surgeon should become experienced with one technique and use it often to obtain consistent results. The Millard rotation advancement lip repair (9-12) is widely used in many cleft centres and can be easily adapted to narrow or wide clefts. It is the technique adopted and modified by the author over the years.

The first step with any lip repair is to locate the normal features of the lip: the midline and Cupid's bow at the cutaneous-vermilion junction (white skin roll), and the vermilion-mucosa junction (red line) (13-15). On the medial segment, the incision of the rotation flap is kept straighter

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Figure 1 **A** Classic Millard drawing with rounded medial rotation flap (a), lateral advancement flap with incision around the alar base (b), columella based flap (c), white skin roll and Cupid's bow (d), and red line (e). **B** Modified Millard drawing with straighter medial rotation flap and shorter incision at the base of the nostril on the lateral flap. **C** Modified Millard drawing with straighter medial rotation flap, short back-cut on medial flap, and curved lateral flap with wider tip and short incision at the base of the nostril

Figure 2 **A** Subcutaneous dissection of the nasal tip with access through the medial skin incision. **B** Subcutaneous dissection of the nasal tip with access through the lateral skin incision. Shaded area depicts the surface undermined over the cartilaginous nasal tip

than originally described by Millard (9-12) (Figure 1) to avoid an excess of tissue in the middle of the lip and a tight closure at the level of the white skin roll. Straightening of this incision also keeps more tissue on the 'c' flap that is used at the base of the columella, elongating the columella and keeping the lip down. Superiorly, the rotation flap does not cross the midline to avoid lengthening the normal side of the lip. The relaxing incision, when needed, is done only after the muscle and mucosa have been completely released, and rarely exceeds 1 mm. The vermilion and mucosa along the cleft are retained as a flap based on the posterior lip mucosa until final adjustments at the end of the closure.

Subcutaneous dissection of the medial lip element is kept to a minimum so that the normal midline dimple is not disrupted. However, the medial muscular attachment to the columella is completely released to level the Cupid's bow. Simultaneous release of the mucosa and frenulum is completed. This allows

easy access to the base of the columella and pyriform aperture for simultaneous closure of the primary palate and nasal tip correction. Scissors are introduced bluntly between the two medial crura of the alar cartilages and both sides of the nasal tip are undermined subcutaneously (Figure 2A).

Next, extending posteriorly from the lip incision, a flap is raised from the septal mucoperichondrium to close the primary palate (Figure 3A). This flap is based inferiorly on the edge of the cleft as originally described by Campbell (16,17) and extensively used by Schmid (18). The width of this flap may vary from 4 mm to 6 mm according to the width of the cleft. It does not need to be as wide as the cleft, because it will be sutured to a lateral mucoperiosteal flap reaching medially to narrow the width of the pyriform aperture symmetrically with the normal side. It is important, when elevating the mucoperiosteum on the premaxilla, to leave intact the mucosa over the alveolar bone to preserve the tooth buds and to keep a normal height of alveolar bone and sulcus along the cleft.

Lateral unit dissection

Millard's original technique has also been modified to reduce the length of the incision around the base of the nostril (Figure 1B and 1C). A scar in this area is often more noticeable, and the muscular dissection and repositioning of the alar base can effectively be done subcutaneously. The incision along the cleft can also be rounded (Figure 1C) to gain more length in wide clefts and to provide a wider tip of the flap to insert above the medial lip flap. The vermilion and mucosa along the cleft are retained based on the inferior border of the lip until final mucosal adjustment at the end of the lip closure.

Once the skin incision has been made, the muscle is undermined laterally more extensively than on the medial side. The muscle is completely freed from the alar base and the periosteum along the pyriform aperture. The deforming force of the orbicularis oris on the nasal tip (lateral and superior pull on ala) is therefore released and nasal tip correction is easier. This allows for a substantial amount of muscle fibres to be brought medially to be reattached at the base of the columella, centralizing the columella and lengthening the lip. Once the muscle is released from the ala nasi, it gives an easy access to undermine

Figure 3) A Incision of the medial vomer flap (m) on the nasal septum and incision of the lateral flap (l) along the cleft at the junction of the oral and nasal mucosa. B Incision of the medial and lateral mucosa (mu) in the sulcus adjacent to the gingiva (g). C Transposition of the medial (m) and lateral (l) flaps to obtain a two-layer closure of the primary palate

the nasal tip subcutaneously over the alar cartilage (Figure 2B). Blunt scissors are used to reach the nasal tip already dissected through the medial lip incision. The dissection is carried from the nostril rim superiorly over the alar and upper lateral cartilages on the cleft side, extending over to the normal side in the tip area only. No dissection is performed over the nasal bones and the cartilage is left attached to the mucosa.

The lateral lip mucosa is incised in the sulcus to create a mucosal flap that is brought medially. The lateral mucosa is undermined only in the upper portion of the lip, never on the free edge, to avoid thickening of the lower lip border. The incision of the mucosa and periosteum is carried posteriorly along the edge of the cleft at the junction of the oral and nasal mucosa. This allows elevation of a lateral mucoperiosteal flap (Figure 3A), based superiorly, along the pyriform aperture under the lower turbinate. This flap is advanced medially to narrow the pyriform aperture to a normal size and to provide a two-layer closure of the floor of the nose as it reaches under the raw surface of the medial mucoperichondral flap (vomer) (Figure 3C).

Closing the defect

To properly realign all the structures, the first step should be to obtain symmetry of the nasal domes. A suture is placed above the contralateral nasal dome, obliquely through the dome of the alar cartilage on the cleft side and back through the normal side following the principle of the McComb repair. This suture is not tied at first, but kept long and anchored to the head drape as a continuous traction on the nasal tip to keep the domes symmetrical during the lip closure. It is tied over a bolster at the completion of the procedure.

Then, the pyriform aperture and the floor of the nose are closed to provide a stable base for the lip repair and to avoid an oronasal fistula (Figures 3C and 4B). The medial inferiorly based vomer mucoperichondral flap is rotated down toward the mouth. It is covered by the lateral superiorly based mucoperiosteal flap that is brought medially to close the floor of the nose and reach the midline. As opposed to the frequently used Veau technique (19,20), in which the vomer flap is raised with a superior base, the Campbell inferiorly based vomer flap provides a two-layer closure of the anterior palate and pyriform aperture. The raw surfaces of the medial and lateral flaps slide

Figure 4) A Completed lip closure with insertion of the lateral vermilion flap to widen the medial vermilion, and nasal tip correction with traction suture. B Oral view of the closed primary palate and lip with mucosal flaps. e Red line; g Gingiva; m Medial flap; mu Mucosa

on each other in a 'double-breast manner'. Mattress sutures are inserted from the mouth into the nasal floor and tied into the mouth on the vomer flap. In cases in which the maxilla and the base of the ala on the cleft side are retrusive in comparison with the premaxilla and normal alar base, it is necessary to release further the periosteum to allow the base of the nostril that is anchored to the lateral flap to advance anteriorly at the same level as the contralateral alar base.

As the nostril floor closure reaches the premaxilla, the vomer flap is sutured to the lateral lip mucosa (Figure 4B) to provide complete closure of the sulcus and avoid a vestibulo-nasal fistula. The lateral lip mucosal flap is anchored to the medial lip mucosa in the sulcus to lengthen the medial lip mucosa.

After obtaining a symmetrical nasal tip, and closing of the pyriform aperture (maxillary cleft), nasal floor and labial sulcus, the lip closure can then be completed. The lateral orbicularis muscle fibres released from the base of the nose are reattached to the base of the columella, above the fibres of the medial orbicularis. This serves two purposes: to centralize the columella and to provide muscle bulk to adequately lengthen the medial segment. In fact, the lengthening of the medial lip

Figure 5) Preoperative (A) and immediate postoperative (B,C) results of lip, nose and primary palate closure in complete cleft lip and palate

to obtain adequate symmetrical height has little to do with the skin incision that is used – it is not a cutaneous correction. It is the muscular closure that provides a good lip length that will be maintained with growth. Once the central segment has been brought down to a symmetrical height, the muscular closure is continued caudally to the vermillion. The muscle closure should bring the skin edges together. A single suture is placed in the dermis at the level of the white skin roll, and no other suture is used on the skin. After closure of the orbicularis, the final adjustment of the nasal base and columella can be made. Sutures are placed between the nostril base, still in continuity with the lateral periosteal flap, and the mucosa attached to the vomer. The 'c' flap is also trimmed and sutured at the base of the columella. The exact position of the 'c' flap varies from one case to the other depending on the width of the cleft, as well as on the need for more or less skin in the defect created by the rotation of the medial flap once the lateral flap has been advanced.

Lastly, the mucosal flaps are adjusted along the vermillion border. The vermillion (dry red lip) is narrower on the medial cleft side compared with both the normal side and the lateral side of the cleft (13,15). It needs to be increased with the same type of dry red tissue for a good colour match. The vermillion below the white skin roll is closed in a straight line until it reaches the vermillion-mucosa junction on the medial lip. Then the lateral vermillion, which is wider, is advanced medially as a triangular flap to increase the medial vermillion. Next, the medial mucosal flap is advanced laterally on the undersurface of the lip (Figures 4A and 4B). This will avoid a straight line closure of the lower border of the lip, which may cause a whistle deformity. Having this medial mucosa available as a flap to increase the lateral mucosa is also very helpful in wide clefts where the lateral lip is thinner. Only after final mucosal adjustment is the extra tissue discarded.

The traction suture of the nasal dome on the cleft side is then released from the drapes and tied over a bolster on the nasal mucosa side and over the skin. If the dome symmetry is estimated to not be adequate, the suture can easily be reinserted at this stage before the bolsters are placed. The traction suture and bolster are left in place for 10 to 12 days. Laterally, even after the base of the nostril has been anchored symmetrically, there is a tendency toward flaring of the ala. It can be controlled with sutures between the nasal mucosa and the nostril crease. Through and through sutures tied over the mucosa are often used without the need for bolsters. The dimple in the skin created in the nostril crease is rarely noticeable.

No sutures are necessary on the skin because the muscle closure brings the skin edges together. Surgical glue is applied, making sure that the skin approximation is perfect. Surgical tapes are then apposed.

The result obtained at the completion of the procedure remains stable with growth, and, if the structures have been meticulously aligned, revisions are rarely necessary. Three different patients are presented in Figures 5 to 7 with results immediately postoperative, and after six and 18 years of follow-up without any revisions to the lip, nasal tip or primary palate. The posterior cleft palate is closed in a separate procedure, leaving no anterior fistula. A bone graft is inserted in the alveolar cleft during mixed dentition. Because the soft tissues of the primary palate have already been closed at the time of lip repair, the bone graft is simply inserted under the flaps, making the procedure easier.

DISCUSSION

These combined procedures are generally performed at 2.5 to three months of age. In these young babies, airway monitoring is essential. The size of the airway is drastically changed after lip closure and nostril reshaping. There is more resistance to breathing, and the child has to adapt to it. Furthermore, the baby has never experienced mouth closure before the procedure and will not spontaneously open his mouth to breathe if the nose is obstructed (obligatory nasal breathing in young children). The presence of a bolster under the nasal dome and postoperative edema may further reduce the airway. Another factor to consider is the partial obstruction of the normal nostril due to the septal cartilage deviation, which is particularly severe in wide clefts. Continuous oxygen saturation monitoring is recommended for at least 24 h, and narcotics should be used sparingly.

McComb (21) and McComb and Coghlan (22) have published long-term results with primary nasal tip corrections. The symmetry of the nasal tip that can be obtained with the subcutaneous dissection of the nasal domes and traction sutures without nasal incisions is not perfect in all cases, but it is certainly acceptable so as to avoid secondary corrections before growth completion (23). The nasal tip subcutaneous undermining presented here is less extensive than in the original technique proposed by McComb, in which the undermining was carried over the nasal bones. Traction sutures are also inserted directly in the nasal tip area rather than long sutures in the nasion area; it is easier to insert and adjust the traction to obtain dome symmetry. Scarring under the bolster has not been a problem. Salyer (24) also uses shorter traction sutures; however, his technique is different – the alar cartilages are dissected free from the skin and the mucosa. Correction of the septal cartilage deviation remains an area of controversy because of the possible negative impact on nasal growth; therefore, the septum deviation is not addressed at the time of the initial repair.

Vomer mucoperichondral flaps (16-20) to close the primary palate have been used for many decades. In an extensive study on maxillary growth following unilateral cleft lip and palate repair, Ross (25) showed that alveolus repair using soft tissue without the addition of a bone graft did not influence the anterior-posterior growth of the maxilla but may have had some minor effect on the vertical height. The main difference in the Campbell technique, as opposed to the Veau technique, is that the vomer flap, based inferiorly, provides a

Figure 6 Preoperative (A) and postoperative result after six years (B,C,D,E). No revisions took place following primary lip, nose and primary palate closure. Posterior palate closed at one year of age

Figure 7 Preoperative (A) and postoperative result after 18 years (B,C,D,E,F). No revisions to the lip or nasal tip took place, the posterior palate closed at one year of age, bone graft in alveolar cleft took place at age 10 years and septoplasty was performed at age 17 years. Computed tomography scan (G) demonstrates bone graft incorporation before the insertion of an osteointegrated implant for missing lateral incisor

two-layer closure adaptable to wide clefts without any tension because the flaps can slide on each other, leaving more or less raw area laterally or medially. The vomer and lateral flaps originally designed by Campbell (16) were much larger than the flaps used in our centre. Campbell also included some oral palatal mucosa in his lateral flap. It is not necessary to add palatal mucosa to the lateral flap; the incision is located along the edge of the cleft and elevated on the nasal side, under the lower turbinate.

The extent of the muscular dissection to relieve the deforming action of the abnormal insertion of the orbicularis oris remains an open debate. The muscular insertions on the lateral nostril, pyriform aperture and the columella must certainly be freed (6-8). However, extensive undermining of the cheek as proposed by Delaire (26) does not seem necessary. There is always a risk with very extensive dissection that the innervation and blood supply to the orbicularis may be affected.

Presurgical orthopedics is now widely used to reduce the width of the cleft before surgery. Our centre has used the nasoalveolar molding technique as described by Grayson et al (27) for the past six years. It is interesting to note that, even if the surgical correction is easier in a narrow cleft, the surgical results after the introduction of presurgical orthodontics have not improved. In fact, in some children, the flare of the nostril

has been more difficult to control after stretching of the nasal tip before muscular release on the ala. Many authors still like to use surgical adhesion before formal lip repair, even in the era of presurgical orthopedics. It is never used in our centre.

CONCLUSION

We believe that a complete reconstruction of the primary palate, nose and lip in one setting is a better option for children presenting with a cleft lip and palate. The majority of children with cleft lip and palate require only this early surgery at three months of age, one for posterior palate closure, one for alveolar bone grafting in mixed dentition and one at the end of growth for septal correction when needed. Fewer revisions mean less scarring and more predictable results. The first surgeon definitely has the best chance for a good result.

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