Unilateral Cleft Lip: Principles and Practice of Surgical Management

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Abstract

Keywords

- cleft lip
- cleft palate
- cleft lip nasal deformity
- alveolar molding
- surgery

Management of cleft lip and palate requires a unique understanding of the various dimensions of care to optimize outcomes of surgery. The breadth of treatment spans multiple disciplines and the length of treatment spans infancy to adulthood. Although the focus of reconstruction is on form and function, changes occur with growth and development. This review focuses on the surgical management of the primary cleft lip and nasal deformity. In addition to surgical treatment, the anatomy, clinical spectrum, preoperative care, and postoperative care are discussed. Principles of surgery are emphasized and controversies are highlighted.

Surgical management of cleft lip involves changing techniques and evolving principles. Although Gillies and Millard's principles of surgery can serve as a framework for reconstruction,¹ overall care has broadened to a multidisciplinary team approach with a focus on the patient and family. The American Cleft Palate-Craniofacial Association has established standards for treating centers that encompass team composition, team management, communication, cultural competence, psychological/social services, and outcome assessment (www.acpa-cpf.org). Although the focus of this review is on the specifics of surgery, the importance of a team-based approach and concentration of care in specialized high-volume centers is emphasized.

Presentation

Embryology, Epidemiology, and Associated Conditions

At 4 to 6 weeks of gestation, the medial nasal, lateral nasal, and maxillary processes fuse to form the nose, upper lip, and primary palate. Posterior to the incisive foramen, the secondary palate develops from the fusion of lateral palatine processes at 6 to 12 weeks of gestation. Failure of mesenchymal penetration results in a wide spectrum of cleft presentations.

Cleft lip with or without cleft palate occurs in ~2 of 1000 Asians, 1 of 1000 Caucasians, and 0.5 of 1000 African Americans with a 6:3:1 ratio of left:right:bilateral involvement. The

condition is more common in boys and is usually sporadic. In contrast, isolated cleft palate occurs in 0.5 of 1000 newborns regardless of ethnicity. The condition is more common in girls and syndromes are more frequent. The most common syndromes are van der Woude (lower lip pits), Stickler (type 2 collagen abnormality with myopia, retinal detachment, and glaucoma), and 22Q11 deletion (multiple facial characteristics, developmental delay, and other associations).

Anatomy

The *vermillion* is the red part of the lip that is exposed and dry. It is composed of keratinized squamous epithelium and has an abundance of superficial capillaries. The *white roll* is the shiny convex prominence above the vermillion that is characterized by sparse vellus hair. The *vermillion border* is the junction between vermillion and white roll.

The *mucosa* is the pink lining of the oral cavity that is composed of nonkeratinized squamous epithelium.² It is unlike dry vermillion in that chronic exposure from inadequate vermillion reconstruction results in parakeratosis and chronic chapped lips. The *red line* is the junction between vermillion and mucosa.³

The *Cupid's bow* is defined by the horizontal double curve of the lip and has two peaks. The *philtrum* is defined by a central *depression* flanked by *philtral columns*. Deep to the skin, the *pars peripheralis* of the *orbicularis oris muscle* (OOM)

forms a compact decussation at the midline with fibers inserting into skin on either side of the philtral ridges.⁴ The deep component originates from the modiolus and acts as a sphincter, whereas the superficial component originates from the muscles of facial expression and acts as a retractor.⁵ At the lower end of the OOM the *pars marginalis* turns more superficial forming a distinct J shape on sagittal section that contributes to the pout of the lip on profile.

The unilateral cleft lip deformity is characterized by progressive tissue deficiency and tethering of structures to either side of the cleft. On the medial side, the lip is short, the philtral column is flattened, and the vermilion is narrow. Similarly, on the lateral side, the vermilion border and red line start parallel to one another, but converge as they approach the cleft. Noordhoff's point is found along the lateral lip where the vermilion height is at its greatest³; here, the white roll is well formed, but becomes less distinct toward the cleft. Similar to the overlying tissues, there is a progressive deficiency of OOM. Disruption of muscle is associated with misdirection of OOM fibers into the alar base and columella.⁶ The nasal floor, alveolus, and palate can also be involved. Disruption of the alveolar arch results in a splayed skeletal base and untethered growth on one side of the premaxilla. The anterior nasal spine and caudal septum deviate toward the noncleft side, while the alar base remains tethered to a repositioned lesser segment. Separation of the nasal base elements results in collapse of the arch forms that normally define the nose.^{7,8}

Classification/Clinical Spectrum

Kernahan proposed a system to classify cleft lip and palate with the incisive foramen as the central landmark and a Y-shaped diagram where components could be stippled

(complete) or striped (incomplete) to indicate the extent of clefting (►Fig. 1a).⁹ Kriens proposed another system that used letters to represent components, with capitals for complete clefts and small letters for incomplete clefts.¹⁰ Letters run from the patient's right to left so that a complete bilateral cleft of lip, alveolus, hard palate, and soft palate would be represented as "LAHSHAL" (►Fig. 1b).

Unilateral cleft lip has been further described as "complete," with Simonart band, incomplete, or microform. A *Simonart band* is a soft tissue bridge that is devoid of muscle, spans the lip elements, and can be differentiated from an incomplete cleft by the presence of a complete alveolar cleft.¹¹ It is found in 30% of patients.¹² A *microform cleft lip* is a very mild form of incomplete cleft lip, whose features can variably include indented mucosa, notched vermilion, disrupted white roll, furrowed philtral skin, flattened nasal sill, and displaced nasal ala.^{13,14} Even more subtle forms of isolated OOM disruption have been identified, but these may be more relevant for genetic study.^{15,16} Onizuka differentiates microform clefts from incomplete clefts by a deformity that extends to less than one fourth of the height of the lip.¹³ Yuzuriha defines a microform cleft as one where the medial vermilion-cutaneous point of the cleft is < 3 mm above the normal Cupid's bow peak.¹⁴

Presurgical Molding

Early in life, malleable tissues and rapid facial growth provide an opportunity to correct the position and shape of the skeleton in preparation for definitive reconstruction. Passive molding can take the form of lip taping, alveolar molding, and nasoalveolar molding; active molding involves the Latham device. *Lip taping* produces an indirect restraining force on

Fig. 1 (a) Kernahan's "Y"; (b) LASHAL classification; (c) anthropometric analysis adapted (Fig. 1c reproduced with permission from Fisher DM, Tse R, Marcus JR. Objective measurements for grading the primary unilateral cleft lip nasal deformity. *Plast Reconstr Surg* 2008; 122:874–880).

the alveolar segments that is simple, inexpensive, and can reduce an alveolar gap by 53%.¹⁷ *Alveolar molding* (AM) involves a custom appliance that is adjusted regularly to guide palatal growth. Although AM affords greater control of the arch form, the molding plate can cause irritation and ulcers, results rely on a skilled orthodontist, and the frequent visits can be a burden to the family. Long-term studies have also found no difference in the ultimate alveolar form.^{18,19} *Nasoalveolar molding* (NAM) is an extension of AM that includes a nasal stent to support the nasal dome once the alveolar segments are aligned (< 6 mm gap or normal arch form).^{20–22} Many studies have demonstrated improved pre-operative nose form; however, long-term improvements are still unclear.^{23–28} In addition to the risks and burdens of NAM, overly aggressive NAM can produce a “mega-nostril” by overstretching the ala while it is still tethered to the alveolus.²⁹ *Active molding* was introduced by Latham and involved manipulation of the alveolar segments using a pin-retained, screw-actuated appliance. Although active molding provides more control, it has not been widely adopted due to concerns of growth disturbance and the need for anesthesia for installation.^{30,31}

Lip adhesion is a partial repair of the cleft lip that produces a restraining force on the alveolar segments and can reduce the gap by 60%.^{32,33} Various techniques have been described,^{34,35} but the common approach involves repair of tissues along the cleft margin that would normally be discarded. Proponents argue that conversion of a cleft to a less severe form facilitates definitive repair,^{34,36,37} while skeptics argue that the additional surgery is unnecessary and the scar compromises the ultimate outcome.^{38–40}

The use of presurgical molding or lip adhesion is based upon the cleft, family, available expertise, and surgeon preference.

Primary Repair of the Unilateral Cleft Lip and Nose

Analysis

“Diagnose before you treat” – Sir H. Gillies¹

Analysis of the specific cleft deformity is important for surgical design. Formal anthropometric measurement is useful to objectively document the deformity and the severity (►Fig. 1c).^{41,42} At minimum, analysis considers the lateral lip height, medial lip height, horizontal lip length, and nostril dimensions.

Planning and Design

“Make a plan and a pattern for this plan” – Sir H. Gillies¹

An ideal technique should facilitate the creation of a balanced lip, allow for adjustments, and produce a favorable pattern of scar. Although each method has its own merits, the surgeon should select one that compliments his or her style. In *Cleft Craft*, Millard details much of the history of cleft lip repair.³⁵ Recognizing the need to lengthen the lip, Rose⁴³ and Thompson⁴⁴ designed concave excisions of the cleft margins that provided length when closing in a straight line. This is now known as the *Rose-Thompson effect*. LeMesurier lengthened the lip with a Z-plasty, placing the peak of the lateral lip into the center of Cupid’s bow (►Fig. 2A). Although the lip form produced was favorable,⁴⁵ the orientation and position of scar was not ideal. Modern techniques of cleft lip repair incorporate some form of Rose-Thompson effect, Z-plasty, or both.

The Tennison-Randall Approach

Tennison was inspired by LeMesurier, but moved the Z-plasty to the cleft side Cupid’s bow peak.⁴⁶ Randall built on the

Fig. 2 Designs for cleft lip repair and expected lines of closure: (A) LeMesurier; (B) Tennison-Randall; (C) Millard II; (D) Mohler; (E) Fisher.

design using anatomic landmarks and a geometric pattern (►Fig. 2B).⁴⁷ The Tennison-Randall technique involves a back-cut that extends from the cleft Cupid's bow peak toward the center of the philtrum that is filled by a laterally based triangular flap whose width is the measured deficiency in lip height. Two points of closure along the nostril floor are designed so that when they are brought together the nasal deformity is corrected. From these two points, corresponding lines are dropped to the cleft Cupid's bow peak medially and to the base of the triangular flap laterally (►Fig. 3A). Calipers can be used to facilitate the final design by making intersecting arcs swung from the lateral lip (the selected Cupid's bow peak) and lateral nostril point of closure. Cronin suggests placing the triangular flap 1 mm above the vermilion to optimize definition of the repaired white roll.⁴⁸ Brauer suggests making the repaired side 1 mm shorter than the noncleft side to avoid making the lip too long.⁴⁹ In the case of incomplete cleft lips, the lateral lip element may be too long and can be shortened by full-thickness excision below the ala.⁵⁰ The Tennison-Randall repair relies upon rigid geometric design rather than surgeon experience and is particularly useful for wide clefts with severe vertical deficiency. However, the technique has been criticized for producing lips that are too long and the closure does not follow borders of anatomic subunits.

The Millard Approach

With the goal of preserving the philtral dimple, Millard described the rotation-advancement repair (►Fig. 2C) that emphasized minimal tissue discard, a "cut as you go" approach, and placement of scars that better respect anatomic

borders.⁵¹ On the medial side, a curvilinear incision extends upward from Cupid's bow peak toward the noncleft philtral column. Downward rotation of the philtrum corrects the deformity and leaves a gap. Advancement of the lateral lip fills the defect, corrects the alar flare, and narrows the nostril floor. Finally, a superiorly-based C-flap is elevated and transposed for nasal floor closure. The overall tissue rearrangement is much like a Z-plasty.

Although the Cupid's bow peak on the medial side of the cleft is fixed, selection of the corresponding point on the lateral lip considers the available lateral lip height (►Fig. 3B). Measurement and transposition of the horizontal lip length from the normal side tends to produce a point that is very medial and incorporates deficient cleft tissues.^{3,52} Noordhoff's point is further lateral and ensures adequate tissue quality, but not necessarily the required lip height.⁵³ If further height is required, the upper end of the advancement flap is limited by nasal sill and the design is moved lateral on the lip until sufficient height to match the medial lip incision is attained (►Fig. 3B). Although sacrifice of horizontal length can give the vermilion a thinned appearance, leaving a deficiency in vertical height is a much more obvious asymmetry.^{54,55}

Numerous modifications of Millard's original technique have been described. A back-cut at the end of the rotation incision allows greater rotation.^{35,56} Another small back-cut, in or above the white roll, can be filled with a lateral triangular flap to drop the Cupid's bow further.^{41,56,57} In the case of a vertically oriented philtrum, the rotation incision can be kept on the cleft side to avoid crossing anatomic borders.⁵⁷ Millard described extending the advancement incision around the

Fig. 3 Design details. Incisions are in black, measurements are in white and corresponding points are indicated: (A) Tennison-Randall; (B) Mohler; (C) Fisher—before final lateral lip design; (D) Fisher—lateral lip components and variations in design.

alar base; however, this should be abandoned as it is unnecessary and produces a conspicuous scar.^{35,56} Millard also described using the C-flap to lengthen the columella, especially if a back-cut is added to the rotation incision. Stal has compiled a comprehensive description of the many subtle variations used by notable surgeons.⁵⁸ An important modification is that described by Mohler.

The Mohler Modification

Dissatisfied with a scar that traverses the upper third of the philtrum, Mohler modified Millard's repair and used the columella to lengthen the lip (►Fig. 2D). The rotation incision is designed to mirror the normal philtral column and extends onto the columella (►Fig. 3B).⁵⁹ A back-cut is designed to end at the lip-columellar junction and the C-flap is used to both fill the columellar defect and abut the rotated lip segment. Lip closure follows anatomic subunits and the concept of using the columella to lengthen the lip has gained popularity.^{54,58,60}

The Fisher Approach

Fisher recently described another approach to cleft lip repair that avoids scars on or under the columella and is not limited by deficiencies of lateral lip height or width. The design is measured and geometric, but uses anatomic landmarks to place closure along borders of anatomic subunits. Lip length is attained by the Rose-Thompson effect and a small triangle placed within the concavity immediately above the white roll (►Fig. 2E). Compared with other techniques, it is a "measure twice, cut once" style of repair. The design relies upon 25 landmarks and can be time consuming.

The sequence of landmarks begins with central and non-cleft side points so that the corresponding cleft side points can be measured and identified. Three points are placed along the crease between the lip and columella: the center and the two peaks of the philtral columns. While manually correcting the nasal deformity, two points are placed at each alar base: the subalare (lowest part of the ala) and the alar insertion point (junction of ala and sill). An arbitrary point is identified within the noncleft nostril that is collinear with the two noncleft alar base and the two noncleft columellar landmarks. The arbitrary point can then be transposed to the cleft side to produce two points along a line of closure (►Fig. 3C). By manually bringing the points of closure together, the nasal deformity should be corrected.

On the medial side of the lip, the center and two peaks of the Cupid's bow are identified along the vermilion border, above the white roll, and along the red line. The medial incision runs along the base of the medial footplate, down the philtral column, and perpendicular to the white roll and red line. A back-cut is designed above the white roll to augment lip height and along the red line to augment vermilion (►Fig. 3C). On the lateral side, Noordhoff's point and the corresponding points above the white roll and along the red line are identified. An incision is designed perpendicular to the white roll and down the vermilion to match the medial lip vermilion height. The remaining vermilion is incorporated into a flap for augmentation. The point above

the white roll defines one fixed point; the previously identified lateral point of closure within the nostril floor defines the other fixed point (►Fig. 3C). Between these two points, three components need to be designed to fit the medial lip markings: the limb along the medial footplate, the length of the cleft-side philtral column, and a small triangular flap (whose width is defined by the relative deficiency in philtral height minus 1 mm because of the Rose-Thompson effect). The angle between each limb can be varied much like the limbs of an articulating ruler so that the components span the two fixed points (►Fig. 3D). Although the planning for a Fisher repair is extensive, there is less reliance on surgeon experience, and the anatomic basis allows it to be reliably applied to a wide spectrum of clefts.

Comparison of Techniques and Changes with Growth

It is difficult to compare different designs of lip repair due to variations in cleft severity and surgeon expertise. Although outcomes of traditional triangular and rotation-advancement repairs have been found to be similar,^{61–63} rotation-advancement tends to produce short lips when used for wide clefts.^{62,63} For this reason Meyer uses a Tennison-Randall repair for wide clefts and a Millard repair for narrow clefts.⁶⁴ The suggestion that imbalances occur from differential growth has been challenged by studies that have found relative lip dimensions to be stable with both triangular^{62,65} and rotation-advancement^{54,55,66–68} repairs. The immediate result is likely the best predictor of eventual outcome, and the results of surgery rely on more factors than just the surgical markings.

Wide Surgical Release

"Treat the primary defect first" – Sir H. Gillies¹

Although Gillies' notion of wide surgical release is based upon traumatic deformities, the principle is well applied to clefts. The lip and nose are tethered to the distorted underlying anatomy; much like a burn contracture, there is a point of maximal tension that can be clearly visualized when traction is applied to the lip and nose. Adequate release allows three-dimensional (3D) correction. Wide mobilization over the maxilla permits medial and superior movement, whereas release along the piriform rim allows anterior movements. Correction of the nasal deformity requires that the alar base, lower lateral cartilage, and accessory cartilages are free from the maxilla. Wide muscle release permits functional OOM reconstruction, but dissection should be discriminating. Care must be taken to preserve the philtral depression and the J shape of the orbicularis along the lower lip margin.

Component Reconstruction

"Losses must be replaced in kind" – Sir H. Gillies¹

Nasal Floor

Repositioning of the alar base is crucial in correcting the nasal deformity. In the case of a bony defect, nasal floor closure provides a stable platform for accurate 3D repositioning and

Fig. 4 Options for lateral nasal wall reconstruction and nasal floor closure: (A) Turbinate flap; (B) L-flap; (C) Lateral nasal wall advancement (Base photograph courtesy of Joseph Gruss).

rotation of the ala. Lateral vestibular skin can be apposed to skin along the medial footplate; more posteriorly, lateral vestibular mucosa can be apposed to septal mucosa. Closure even further posterior requires an extended incision along the palatal shelf for elevation of the nasal mucoperiosteum. Single- and double-layer closures of the nasal floor extending into the palate have also been described.^{69,70} An alternate method that preserves the palatal mucoperiosteum uses an anteriorly based turbinate flap transposed 90 degrees (→ **Fig. 4A**). In addition to stabilizing the nose, nasal floor closure facilitates subsequent palatoplasty and alveolar bone grafting by sealing the nasal mucosa along the alveolus when the exposure is wide and easy.

Nasal Sidewall

With great anterior movement of the lateral nose, release of the mucoperiosteum leaves a potential space along the piriform rim. This defect can be addressed in several ways depending upon surgeon preference or the clinical scenario (→ **Fig. 4**). (1) The *turbinate flap* is anteriorly based and rotates 90 degrees to fill the defect after release of the lateral nose. Harvest requires an open cleft palate for posterior access. It replaces like with like tissue and preserves all of the nasal mucoperiosteum that may be used for palatoplasty. (2) The *L-flap* is the marginal lateral lip vermilion and mucosa that would otherwise be discarded with cleft lip repair. Blood supply can be robust if it is based upon periosteum of the lateral nasal wall. The flap is transposed into the defect along the nasal vestibule while more posterior mucoperiosteum is mobilized to close the nasal floor. Although nasal mucosa is

replaced by lip vermilion and mucosa, the L-flap is versatile and can be used in any scenario. (3) *Lateral nasal wall advancement* involves movement of mucoperiosteum in continuity with the rest of the nose as a broad flap. Incision along the palatal shelf allows elevation of mucoperiosteum and a back-cut posterior to the piriform aperture leaves the defect along the bony nasal wall. Although the flap is robust, the release is posterior to the site of greatest tension and a low-lying turbinate can limit the extent of the back-cut.

Following wide release of the lateral nose and component reconstruction, absorbable quilting sutures along the vestibule and alar crease can be used to obliterate the vestibular web, support the lower lateral cartilage, and create better definition for the nose.

Nasal Septum

Disruption of the palatal arch results in untethered growth of palatal segments and rotation of the anterior nasal spine away from the cleft. Displacement of the caudal septum has a ripple effect on the rest of the septum and nasal cartilages.⁷¹ Smahel described correcting the position of the caudal septum at the time of cleft lip repair to improve nasal form.⁷² No alteration in maxillary growth was reported⁷³ and other surgeons report similar favorable results.^{39,74–76} The caudal septum is approached via the medial lip incision and is found behind an often bifid anterior nasal spine. Firm attachments on the noncleft side need to be released to unfurl the cartilage and reposition it to the midline of the face.

Nasal Tip Cartilages

The nasal tip cartilages sit on top of a deformed nasal base. Dissection of the nasal tip was once criticized for potential growth disturbance, but short-term anthropometrics⁷⁶ and long-term subjective analyses^{77,78} have demonstrated no alteration in growth. McComb describes suspension of the cleft alar dome via long sutures tied over bolsters at the glabella,⁷⁷ whereas Tajima describes suspension to the upper lateral cartilage and the contralateral lower lateral cartilage.⁷⁹ Many surgeons have incorporated nasal tip dissection and have used limited vestibular incisions,^{40,41,60} an extensive intranasal approach,^{35,56,80} or an open external approach^{81,82} for exposure. Although the greater dissection affords the ability to manipulate and modify anatomy, it also risks iatrogenic insult.⁸³ Warnings of scarring, vestibular stenosis, micronostril, and other iatrogenic deformities have accompanied⁴⁰ reports of favorable outcomes. Proponents of primary nasal tip rhinoplasty admit that nasal correction can be limited and that there is a “perverse tendency for the genu to slump with time.”^{60,84} Objective long-term audit demonstrates deterioration of alar symmetry over time, especially with wide clefts.^{55,80,85} Nasal revision is performed in 20 to 74% of patients and at some centers most patients go on to definitive septorhinoplasty.^{40,60,86} As such, the balance of surgical manipulation against surgical insult with nasal tip correction at lip repair must be considered.

Controversies in Correction of the Cleft Lip Nasal Deformity

“Never do today what can honourably be put off till tomorrow” – Sir H. Gillies¹

The composite tissues and complex shape make the nose a difficult structure to correct. With presurgical molding, various forms of primary rhinoplasty, and variations in postoperative stenting, the relative impact of each intervention on the ultimate result is unclear. For example, NAM has been associated with improved outcomes without any nasal dissection,^{23,28,87,88} with primary rhinoplasty,^{25,89} and with varying durations of postoperative nasal stenting.^{23,25,28,88,89} Likewise, septal repositioning has been associated with improved nasal form with^{39,60,74,76} and without^{72,75,90} nasal tip dissection. Analysis needs to consider early results, late results, deterioration over time, and treatment outcome at completion. The lack of any universally accepted objective assessment makes comparison of the various components of treatment difficult. While the relative merits of molding and various forms of primary rhinoplasty remain unclear, surgeons need to constantly reassess their outcomes as they relate to their treatment protocols.

Alveolus

Gingivoperiosteoplasty (GPP) is a mucoperiosteal flap closure of the cleft alveolus that is typically performed following NAM if the alveolar segments are in close proximity. Adequate bone can form within the constructed cavity in up to 73% of patients.^{91,92} Although GPP is used with good bone produc-

tion and no apparent alteration in facial growth by some centers,^{73,93} GPP has not gained widespread use due to reported concerns of facial growth disturbance^{30,31,94,95} and variable quality of alveolar bone.^{91,95,96}

Lip Mucosa

Adequate upper buccal sulcus incision and release allows the lateral lip mucosa to advance to meet the medial lip mucosa. If the cleft side buccal sulcus hangs low on the alveolus, the mucosa can be secured to periosteum higher up. Final inset of mucosa requires accurate alignment of the red line.

Lip Musculature

Anatomic studies have emphasized the importance of accurate muscle repair. On the medial side, release of muscle from the columella lengthens the lip and opens a space. On the lateral side, downward rotation of muscle from the alar base creates an “empty triangle.” When the lateral muscle is inserted into the base of the columella, a muscular sling for the nasal sill is created. At the same time, the empty triangle docks against the ala at the nose–cheek junction and the height of the medial lip muscle is augmented. Further muscle repair establishes the oral sphincter, aligns the overlying structures, and reduces tension on skin repair. Particular care should focus on aligning the J shape of the caudal OOM as it contributes to the lip’s natural pout. If a traction stitch is used at the lower end of the muscle, the surgeon must ensure that muscle form is not distorted and the pout is not obliterated.

Lip Skin and Vermillion

Final adjustments are well worth the investment in time as the form achieved at the completion of the procedure predicts the ultimate outcome. The white roll and vermillion should be perfectly aligned and the lip and nose should have balanced form. Adjustments will vary according to the technique used.

Variations for the Microform Cleft Lip

Microform cleft lips can be the least severe, but most challenging to treat. Compared with more severe clefts, results of surgery are less dramatic, risks of surgery are the same, and family expectations can be high. In appropriately selected microform cleft lips,^{13,14} the disruption of white roll, vermillion, and mucosa can be addressed by a limited excision and triangular flap augmentation of deficient skin and vermillion, when necessary.¹⁴ Disruption of muscle should be repaired and the alar base can be repositioned by lenticular excision or V-Y advancement. If skin/vermillion excision is minimal or not needed, an intraoral approach can be used to access muscle for repair.^{14,97}

Aftercare

“The after-care is as important as the planning” – Sir H. Gillies¹

Fig. 5 Case example of complete unilateral cleft lip and palate—presurgical nasoalveolar molding, Fisher repair, nasal floor closure, L-flap for nasal sidewall, septal repositioning, alar quilting stitch, and conformers for 1 week postoperative. No nasal tip dissection.

Prolonged use of nasal stents for 6 months after surgery has been shown to improve long-term nasal form.⁹⁸ Although other Asian centers report favorable outcomes with use for 3 to 6 months,^{24,28} maintenance requires tremendous efforts and compliance. Adoption of postoperative stents by Canadian and American centers has been variable⁹⁹ and the benefits of short-term use are unclear.

Audit and Outcome Analysis

“Never let routine methods become your master” – Sir H. Gillies¹

Meaningful audit requires standard timing and methods of image capture. Although 2D images are limited by parallax and magnification, 3D imaging is limited in speed and resolution. Use of a protocol that incorporates the modalities available permits eventual outcome analysis and comparison of results. ► **Figure 5** illustrates a favorable result in a child with a complete cleft lip and palate who presented with a moderate to severe cleft lip nasal deformity. The patient underwent NAM, Fisher lip repair, careful OOM reconstruction, nasal floor closure, L-flap for nasal sidewall, septal repositioning, alar quilting, and postoperative nasal conformers for 1 week. No nasal tip dissection was performed. The outcome of this case challenges the notion that nasal tip dissection needs to be performed at primary lip repair. Though expert opinions will continue to be debated, the ultimate answer will rely upon objective audit and careful outcome analysis.

Summary and Conclusions

Management of the child with cleft lip and palate involves a breadth that spans multiple disciplines and a course that lasts from infancy to adulthood. Surgical treatment of cleft lip seeks to produce lasting form and function while considering growth and development. Planning, wide surgical release, and reconstruction of each component remain guiding principles of surgery. Thoughtful analysis of each deformity allows selection of appropriate interventions to address skin, vermillion, muscle, mucosa, nasal floor, nasal sidewall, nasal septum, and nasal tip. Although controversies persist, surgeons need to have a standardized approach with a mechanism for clinical audit to ensure ongoing optimal care.

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