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The Preservation Technique for Incomplete Unilateral Cleft Lip Reconstruction

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Summary: The incomplete unilateral cleft lip shares many of the same phenotypic characteristics as a complete unilateral cleft lip, but key differences include an intact nasal sill, a relative excess of skin in the lateral lip element, and favorable skeletal support. Surgical techniques for incomplete unilateral cleft lips should be tailored to the specific anatomical characteristics, be simple and reliable to perform, and minimize the risk of secondary deformity. Here we describe the "preservation technique" for incomplete unilateral cleft lip reconstruction. The modified design from the anatomical subunit approximation technique uses a nasal sill flap and obviates the need for nasal sill and lateral lip excision. Tissues of the lip are opened out and reorientated to maximize the anatomical advantage. *(Plast Reconstr Surg Glob Open 2024; 12:e6172; doi: 10.1097/GOX.0000000000006172; Published online 18 September 2024.)*

INTRODUCTION

An incomplete unilateral cleft lip is defined by a discontinuity of the upper lip skin, muscle, and mucosa in the presence of an intact nasal sill.[1] The incomplete unilateral cleft lip shares many of the same phenotypic characteristics as a complete unilateral cleft lip; the medial lip element of the cleft is short in vertical height, the medial element vermilion width is narrowed, and there is a discrepancy in the vertical heights between the medial and lateral lip elements. Histological studies have demonstrated a similar arrangement of the orbicularis muscle fibers in incomplete and complete cleft lips, with sparse muscle fibers in the medial lip element running transversely and disorganized muscle fibers attaching to the dermis in the lateral lip element.[2] The incomplete unilateral cleft nasal deformity is surprisingly similar to the complete phenotype, given the intact nasal sill, and includes columella and caudal septal deviation to the noncleft side, widening of the cleft-side alar diameter, slumping of cleft-side lower lateral cartilage, and inferior displacement of the cleft-side alar base.[1,3]

There are, however, key anatomical differences between an incomplete and complete unilateral cleft lip.[4]

First, the incomplete unilateral lip is defined by an intact nasal sill; therefore, the cleft-side nares are closer to embryological completion than their complete cleft counterpart.[5] The shape of the nares is distorted by the aberrant septal and lower lateral cartilage positioning and exacerbated by the discontinuous orbicularis oris fibers located inferiorly in the clefted lip tissues. It is this orientation and shape of the nostril opening itself that demands the surgeon's attention (Fig. 1).[6] What looks like excess nasal sill on anteroposterior view is best appreciated as misleading on the worm's eye.

Second, the lateral lip element has an apparent excess of skin in comparison with the complete cleft lip, noticed in the upper third of the lip where there is continuity with the other side.[4] This is commonly described as a long lateral lip element.[7,8]

Third, there tends to be better underlying support for the lip and nose due to the absence or incomplete nature of alveolar/palatal involvement, as well as the anterior pull of the lateral lip tissues away from the facial skeleton due to the commencement of nasal closure.[9]

The anatomical differences of an incomplete cleft lip can be viewed as protective factors relating to surgical outcomes of form and function and provide the potential for the cleft surgeon to achieve an excellent postoperative result for the patient.[10,11] However, as the margins of improvement are smaller than for a complete unilateral cleft lip, the pressures and expectations to get an excellent result are increased.[12] Surgical techniques

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for incomplete unilateral cleft lips should be tailored to maximize the anatomical advantage, yet be simple and reliable to perform, while minimizing the risk of secondary deformity.

Techniques for the reconstruction of unilateral cleft lip have evolved over time.[13,14] Previous efforts in the literature to describe specific techniques for incomplete unilateral cleft lip have most commonly been technical adaptions of the rotation-advancement method, originally described by Millard.[1,5,6,9,15,16] Koh et al described the use of a superior triangular flap method specifically for incomplete cleft lip reconstruction.[17] The anatomical subunit approximation technique described by Fisher[7] incorporates an inferior, supra-white roll triangular flap and has been increasingly adopted for unilateral cleft lip reconstruction.[8,18,19] In the original description of the technique, there are specific adaptations detailed for incomplete unilateral cleft lips, which include a wedge excision of nostril sill tissue and a triangular excision of superior lateral lip tissue in the presence of a long lateral lip element. We are not aware of any further publications focused specifically on a modification of the Fisher technique for incomplete unilateral cleft lips.

We describe the "preservation technique" for the reconstruction of incomplete unilateral cleft lip, a modification of the Fisher anatomical subunit approximation technique that emphasizes the preservation of lip and nostril sill tissue.

MARKINGS AND MEASUREMENTS

The markings on the medial lip element follow the fundamental principles of Fisher anatomical subunit approximation[7] with the addition of a nasal sill flap, which resembles the C flap in Millard rotation advancement[15] (Fig. 2).

First, the red line is dotted along the entire length of the upper lip where the dry and wet vermilion mucosa meet. The columella-lip junction is marked in the center and at the peak of both philtral columns. The Cupid's bow is marked on the vermilion-cutaneous border at the

Takeaways

Question: How can the anatomical subunit approximation technique be modified to address the incomplete unilateral cleft lip phenotype?

Findings: We describe the "preservation technique" and demonstrate its utility through image content.

Meaning: The preservation technique provides a simple surgical technique to maximize the anatomical advantage of the incomplete cleft lip phenotype while minimizing risks associated with nasal sill excision.

trough and the two peaks. The peak markings are placed at the medial boundary where the curve flattens out. The Cupid's bow points are then transposed above the white roll, with care to cross the roll perpendicular to it.

Measurements are taken with calipers following the Fisher technique to define the "A length" (total lip height: peak of philtral column to the peak of the Cupid's bow above the white roll on the noncleft side) and "B length" (greater lip height: peak of philtral column to the peak of Cupid's bow above the white roll on the cleft side with the lip gently unfurled with digital pressure). The formula A length – B length – 1 mm = C length is used to determine the need for a back cut on the medial lip element and an inferior equilateral triangle on the lateral lip element.

The Noordhof point is picked using a combination of white roll quality and the convergence of the red line and vermilion-cutaneous border. The Noordhof point is transposed above the white roll. The base of the triangle (C length) and the greater lip height (B length) are orientated in a straight line toward the nose in a way that takes into account the following three considerations: first, the required triangle can be positioned within upper lip skin above the white roll; second, aiming to preserve lateral lip tissue by orientating the incision near to the cleft margin; and third, to position the incision on the crest of the lateral lip elevation before it descends medially into the cleft
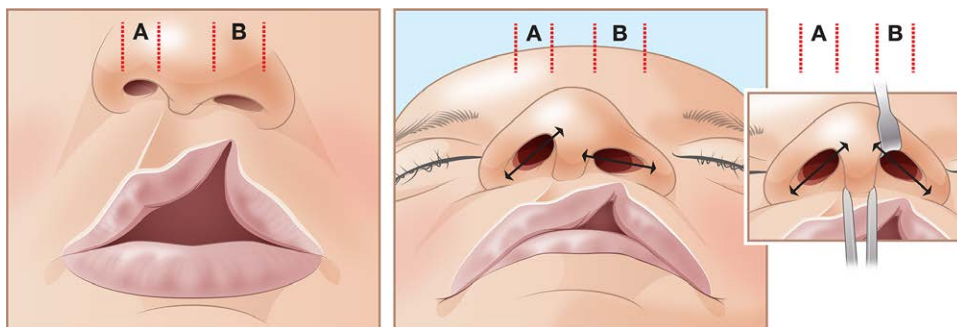

Fig. 1. The incomplete unilateral cleft nasal deformity includes columella and caudal septal deviation to the noncleft side, slumping of cleft-side lower lateral cartilage, and inferior displacement of the cleft-side alar base. The noncleft alar base diameter (A) seems narrower than the cleft-side alar base (B), with accompanying differing orientations of the nares. This can be passively corrected by straightening the columella and lifting the cleft-side lower lateral cartilage, therefore demonstrating that an excision of nasal sill tissue is not required.
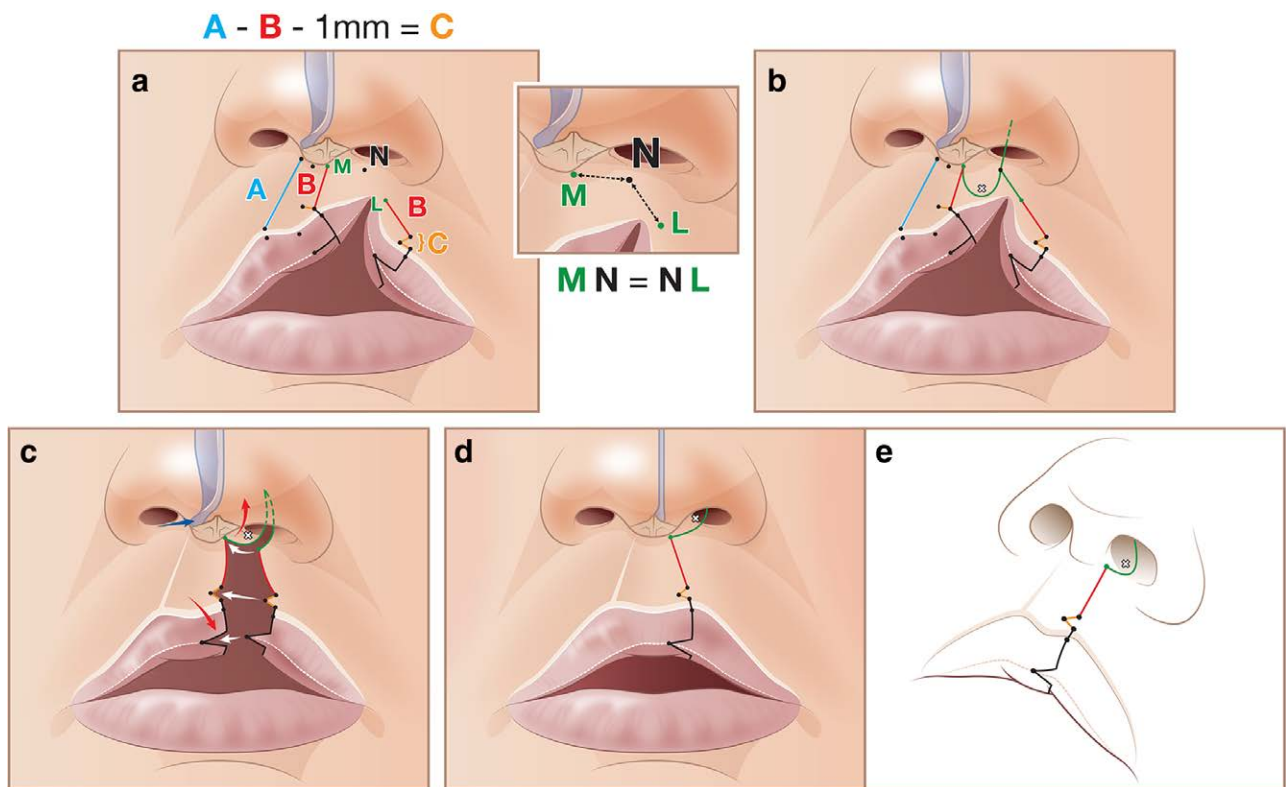
Fig. 2. The preservation technique for incomplete unilateral cleft lip reconstruction. A, Philtral lip lengths are analogous to the anatomical subunit approximation technique described by Fisher. Total lip height (A), greater lip height (B), and lesser lip height (C). The neutral point (N) on the caudal aspect of nasal sill between the medial and lateral lip markings lies equidistant between the medial point M (superior aspect of cleft-side philtral column) and lateral point L (superior aspect of the B length on the lateral lip). B, The nasal sill flap (marked with an X) is relocated into the nasal floor (C) to mimic the curve of the crural footplate and to improve the angle of the columellar labial junction. The surgical end point is shown from the front (D) and oblique (E) views.

tissue. This usually culminates in a line whose inclination can be intuitively drawn from the Noordhof point toward the center of the nostril sill.

The markings thus far resemble the Fisher design but now differ to converge at a common neutral point on the caudal margin of the nasal sill (point N), which negates the need for any wedge excision of tissue at the nostril sill.

Point N is marked on the caudal margin of the nasal sill, equidistant between the peak of the philtral column medially (M for medial: a relatively fixed point) and the peak of the B length laterally (L for lateral: a slightly more interpretive point reliant on design). Almost invariably though, the N point will be marked near the middle of the nostril opening, sitting in the likely point where tissue fusion had started to occur on the nasal floor. Point N can be moved slightly medially or laterally to achieve equidistance from the M and L points. It is important to place it at the caudal point of the sill to ensure no nostril floor is taken.

A curved nasal sill flap is then drawn on the medial lip element from the peak of the cleft-side philtral column (point M) to point N, which resembles the Millard C flap. This nasal sill flap will always be moved into the nostril floor in the closure of the cleft. A straight line is drawn

on the lateral lip element from the peak of the B length (point L) to point N to complete the design.

MANEUVERS IN THE LIP

An injection of 0.25% bupivacaine with adrenaline, appropriately dosed by the child's weight, is infiltrated into the surgical field. The medial lip element markings are incised first, and orbicularis oris attachments at the base of the columella, including from the underside of the nasal sill flap. Almost no detachment is made of the muscle from the dermis of the philtral depression or white roll. Care is undertaken to completely incise the angle between the philtral column and the nasal sill flap, to facilitate the movement of the nasal sill flap. Bearing resemblance to the movement of the outside petals in a budding flower, the medial lip can now unfurl with the nasal sill flap opening upward into the nasal sill, working in tandem with the descent of lip tissues downward to balance the Cupid's bow. The nasal sill flap relocation into the nasal floor mimics the curve of the crural footplate, as well as to function as a "handle" to improve the angle of the columellar labial junction. It also assists with centralization of the columella, although septal dissection and relocation is required for the full effect to be realized (Fig. 3).
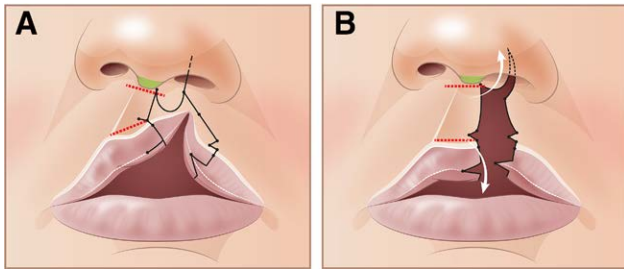
Fig. 3. The vectors of the nose and lip are opposing in the medial lip element (A). The preservation technique allows the medial lip to unfurl, with the nasal sill flap opening upward into the nasal sill, working in tandem with the descent of lip tissues downward to balance Cupid's bow (B).

The lateral lip element markings are incised, and orbicularis oris fibers may be more extensively released superiorly to facilitate medial advancement with minimal tension. Care is still taken to preserve the muscle attachments to the white roll. At point N (at the caudal edge of the nasal sill), the incision is carried posteriorly into the nasal floor without any excision of skin. This incision allows judicious release of the alar base and nostril floor from its abnormally tethered position, allowing redistribution of the skin excess and manipulation to create nasal balance.

Tissues are closed in layers, with muscle approximation being the foundation of the repair. This commences superiorly with the pars peripheralis muscle fibers with the most superior stitch being of vital importance to advance the lateral muscle fibers into the created space at the base of the columella, functioning to set the lip and nose position. This sets the tension of the repair as well as each successive stitch, ensuring the Cupid's bow will be set for balance. The muscle repair will help highlight the pout of the lip, as well as the preserved attachments of the orbicularis to the dermis of the white roll and philtral depressions augmenting those landmarks. 5-0 Prolene is used to approximate the pars peripheralis fibers in the cutaneous portion of the lip and 5-0 Monocryl in the pars marginalis fibers within the vermilion segment of the lip. Attention to the J-shaped fibers of the pars marginalis to exactly align the concave and convex surfaces on either side of the cleft will help create vermilion continuity.

The skin incisions should be well aligned following the muscle approximation, leaving the dermal sutures (subdermal 6-0 Prolene) to ensure exact dermal apposition. The skin sutures (7-0 Prolene) should do nothing more than reinforcing the epidermal closure under no tension. All three layers of closure should "agree."

The first subdermal stitch approximates the peak of the philtral column medially (point M) and the peak of the B length (point L) laterally. The nasal sill flap can then be rotated into the nasal sill with lateral nasal sill tissue in a maneuver to reconstruct the nasal floor. It is of utmost importance that the nasal sill flap is turned more than 90 degrees to ensure its action on the columella, as well as in its contribution to the nasal floor. A certain degree of experimentation with the way the nasal sill flap sets in will help the surgeon understand its role. Apparent excess tissue should not be excised, and careful attention should be made to dermal-to-dermal approximation. The use of nasal stents or dead space sutures will lay this apparent excess of skin into the concavity of the skeletal base at the nasal floor (Fig. 4).

MANEUVERS IN THE NOSE

The anterior nasal spine is identified through supraperiosteal dissection via the medial lip incision. The anterior portion of the cartilaginous septum is defined by sub-perichondrial dissection on the cleft and non-cleft sides, which allows for the septal cartilage to be freely repositioned and centralized. We emphasize the need to dissect both sides of the septal cartilage as the mucoperichondrium often holds the septal cartilage in the deviated shape and dissection of the mucoperichondrium away from the cartilage allows for the septum to be passively straightened. This observed phenomenon may also be the reason that McComb dissection allows the lower lateral cartilage to recontour more effectively after being released from the "memory" imparted by the surrounding soft tissue.[20] The septal cartilage is not routinely actively secured in its straightened position, as following complete anterior perichondrial release, the centralized position is passively maintained.
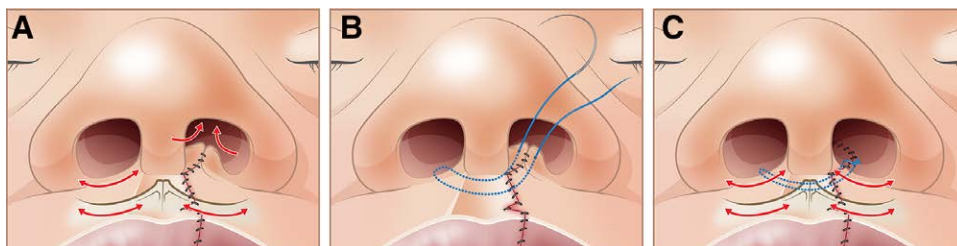

Fig. 4. Apparent excess tissue is to be expected in the cleft-side nasal floor and should not be excised. Careful attention should be paid to achieve dermal-to-dermal approximation (A) with skin stitches, and dead space sutures (B) can help to lay this apparent excess of skin into the concavity of the skeletal base at the nasal floor (C).
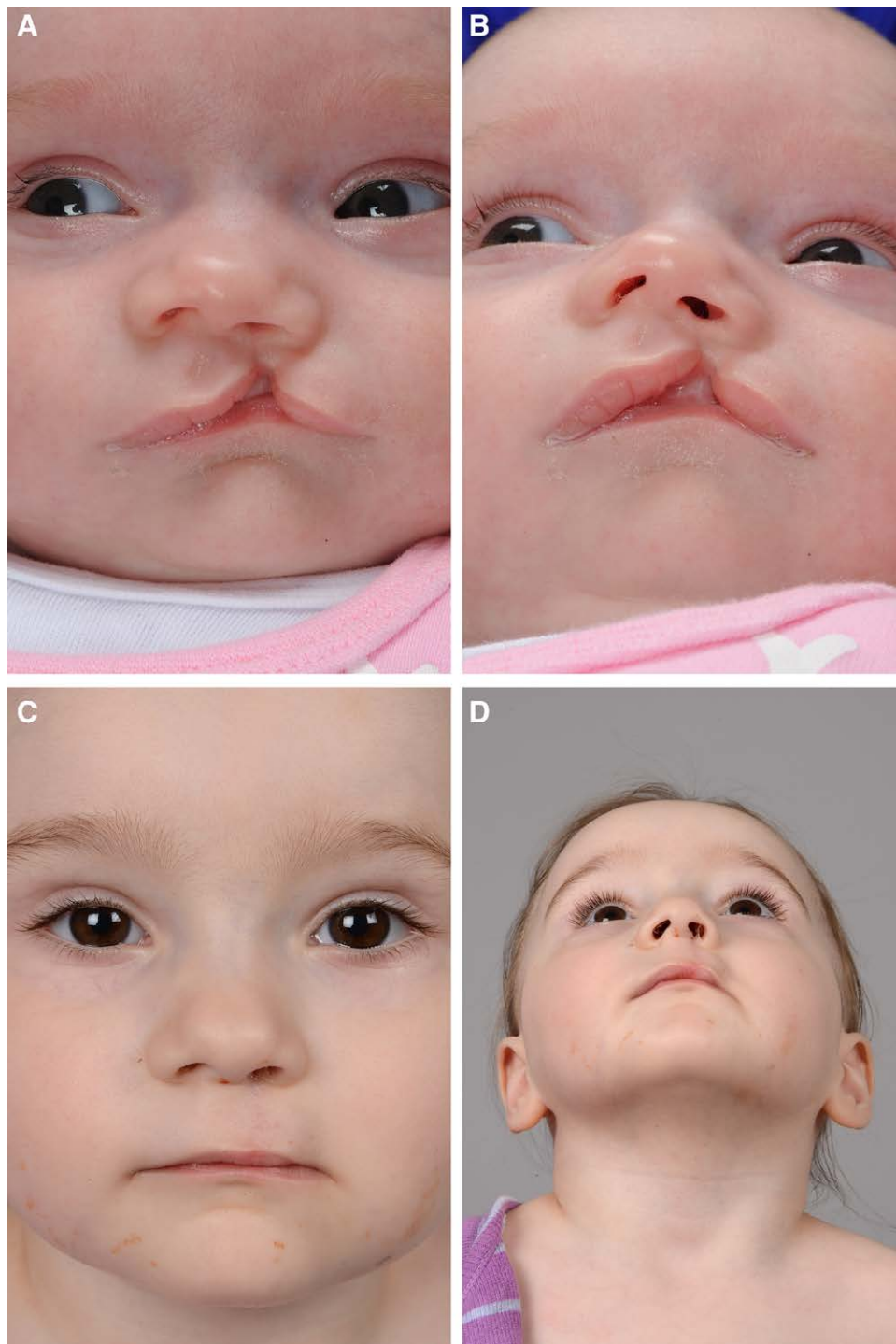
Fig. 5. A patient born with a left-sided incomplete unilateral cleft lip in infancy with frontal (A) and worms-eye (B) views. Surgical reconstruction with the preservation technique was performed at the age of 18 months. Postoperative photographs at 1-year follow-up with frontal (C) and worms-eye (D) views.

Nasal tip dissection is performed through the medial and lateral lip incisions, as well as an additional infracartilaginous incision made on the cleft side. Two types of suspension sutures are placed using 4-0 Monocryl before lip wound closure. Suspension of the lower lateral cartilage mucosa to the upper lateral cartilage and suspension of the lower lateral cartilage to the contralateral nasal periosteum elevates the cleft-side lower lateral cartilage in a deliberate overcorrection on table as previously described.[21] The infracartilaginous incision is closed with
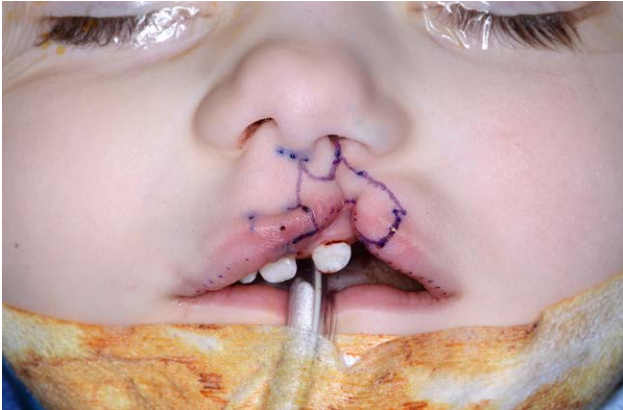
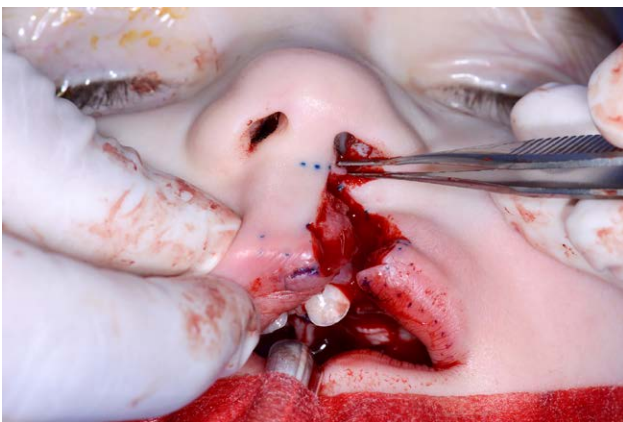**Fig. 6.** Intraoperative marking of the preservation technique

Fig. 7. Intraoperative maneuver to unfurl the medial lip element: the nasal sill flap opens upward into the nasal sill, working in tandem with the descent of lip tissues downward to balance the Cupid's bow.

Fig. 8. On-table result with overcorrection of the cleft-side nostril.

exacting 6-0 gut, with care not to distort the alar rim and is best done before tying the lower lateral suspension suture. At the end of the operation, following skin closure, 4-0

Monocryl stitches are used to reduce dead space in the septum and define the alar crease. Nasal stents made from rolled silicone are secured bilaterally with 4-0 Nylon.

POSTOPERATIVE CARE

Patients are admitted postoperatively for admission overnight. A day case admission is planned at 5–7 days for removal of external Prolene skin stiches and exchange of rolled silicone nasal stents for removable silicone stents. Families are encouraged to keep the nasal stents in situ for 3–6 months.

The preservation technique is illustrated in case examples both pictorially (Figs. 5–8) and in video format. [**See Video (online),** which demonstrate the preservation technique for a patient born with a left-sided unilateral incomplete cleft lip. A closed rhinoplasty technique is demonstrated in this case.] A longer-term result is demonstrated in Figure 9.

DISCUSSION

Millard likened the cleft surgeon to the detective Sherlock Holmes when considering the incomplete unilateral cleft lip: "By collecting what is there with 'infinite pains' and using every available millimeter, the surgeon finds the solution to the mystery."[22]

The spectrum of orofacial clefting is a window into embryological events, and an incomplete unilateral cleft lip provides a good example of tissues presenting at variable stages of arrested closure. It seems intuitive that surgical techniques should differ between incomplete and complete phenotypes, in keeping with the unique challenges associated with each. The anatomical subunit approximation has been widely adopted for unilateral cleft lip reconstruction, which is a testament to the attributes of the technique, whereby tissues are reliably approximated along the boundaries of the upper lip subunits, without compromising lateral lip length. Yet for the incomplete subtype, the excision of specialized nasal sill tissue and a potential additional subalar scar[7] is a challenging undertaking for a less severe phenotype.

The preservation technique differs from Fisher anatomical subunit approximation[7] in the reconstruction of the incomplete unilateral cleft lip by avoiding excision of tissue in either the nasal sill or the lateral lip; and the use of the nasal sill flap. We summarize our thoughts on the preservation technique, with reference to the three key anatomical elements which differentiate the incomplete from the complete cleft lip phenotype:

1. First, with regard to the nostril size. We offer an incision design that obviates the needless wedge excision of the nostril sill and gives access to reorientating nasal tissues. We emphasize the need to level the columellar base to parallel the balanced Cupid's bow, the paramount importance of septal straightening, and the refining incorporation of the nasal sill flap. One must upright the nose by septal straightening and correction of the alar height to appreciate that skin excision in the nasal floor is rarely necessary,
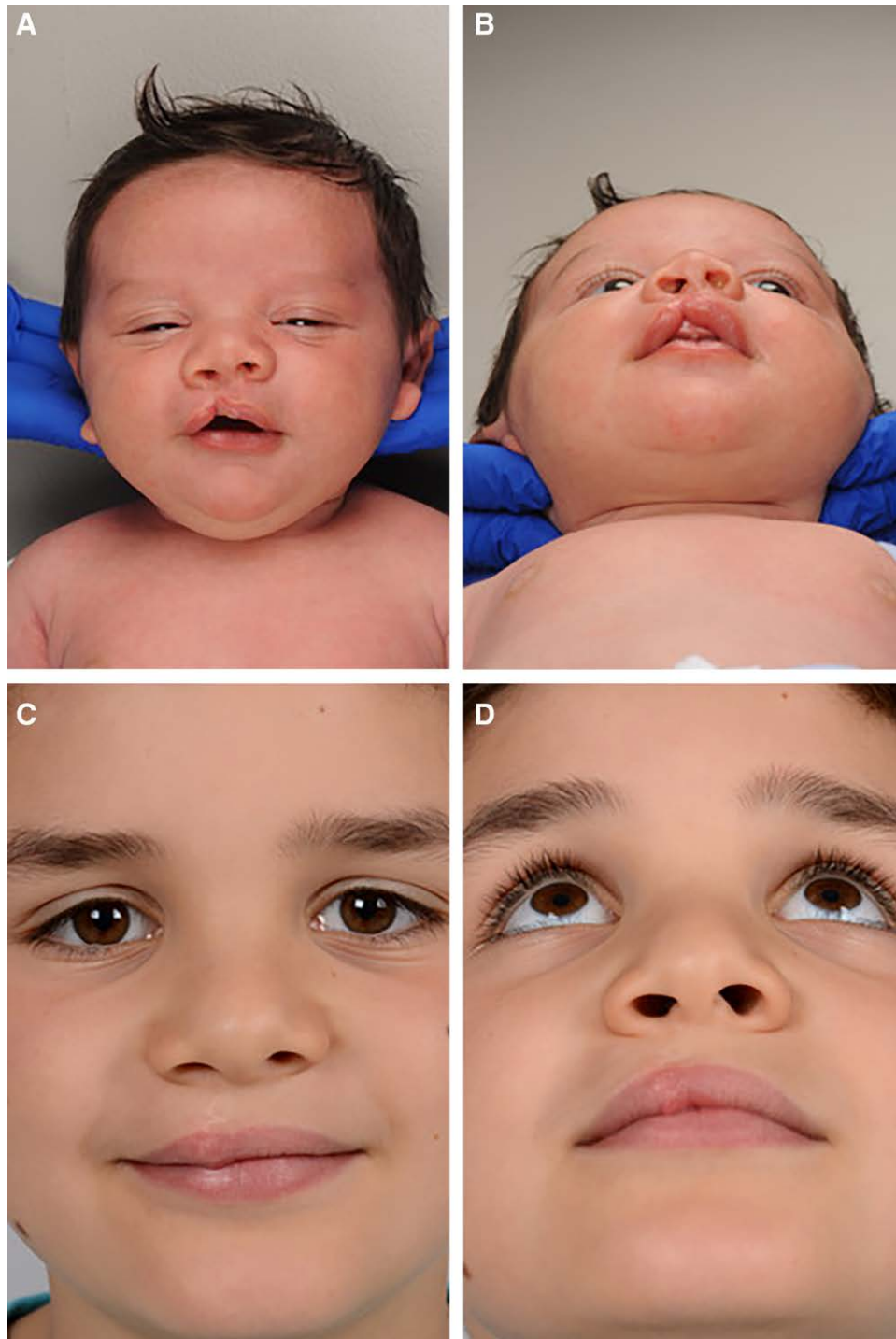
Fig. 9. Longer-term outcomes following the preservation technique. Preoperative images demonstrate the right sided incomplete cleft lip with frontal (A) and worms-eye (B) views. Surgical reconstruction was carried out at 6 months of age. Follow-up images at the age of 8 years with frontal (C) and worms-eye (D) views.

and in fact often detrimental. Incising rather than excising nasal sill tissue reduces the risk of nostril stenosis in a setting where true excess of nasal sill tissue is unlikely. This risk-reducing strategy is pertinent, given the surgical complexity of trying to address cleft-related nostril stenosis, or unequal nostril circumferences.[22]

2. Second, with regard to the lip design and movements, the medial lip needs to be opened (rather than just rotated downward). The upward rotation of the nasal

sill flap helps to reorientate the columella and reconstruct the natural curve of the medial crural footplate. The lateral lip element skin excess does not necessitate excision, but rather, relocating within the nasal floor, by which the cleft-side alar base will also fortuitously be repositioned superiorly into a symmetrical position relative to the other side.

3. Third, with regard to the better underlying skeletal support of the incomplete cleft lip, the nose still needs to be released to varying extents. The amount of dissection required is often underappreciated due to the often-minor changes that were not brought to embryological completion. Nonetheless, the alar base and nasal floor requires an element of judicious release, so the untethering will allow the nose to sit in an improved anatomical form.[15]

CONCLUSIONS

We present the preservation technique for incomplete unilateral cleft lip reconstruction. It is simple to teach and reproducible in the hands of surgeons. The respect for anatomical landmarks combined with a design that has geometric simplicity allows for precise closure of the lip whilst the preservation of tissue allows for artistic versatility in balancing the nose.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

Parents or the guardians of the patients provided written consent for the use of patients' images.

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