Evidence-Based Medicine: The Cleft Lip Nasal Deformity

Cathy Henry, M.D.
Thomas Samson, M.D.
Donald Mackay, M.D.

Hershey, Pa.

Learning Objectives: After studying this article, the participant should be able to: 1. Describe the components of unilateral and bilateral secondary cleft lip nasal deformity. 2. Discuss current methods of assessing the deformity and outcomes. 3. Discuss primary treatment options including the use of preoperative orthopedics, nasal molding techniques, and the primary cleft rhinoplasty. 4. Design a treatment plan for cleft patients that will optimize the outcome of nasal appearance and function. 5. Discuss the evidence regarding outcomes of current practices, and describe areas where more research is needed.

Summary: This is the third Maintenance of Certification article on the secondary cleft lip nose deformity. In the first article, Guyuron defined the deformities and described techniques for the definitive (adult) rhinoplasty. The second article, by Zbar and Canady, presented evidence regarding the assessment, surgical treatment, and outcomes from the literature published between 1999 and 2009. In this article, the authors summarize important points from the first two articles and then concentrate on the evidence for the following topics: (1) methods currently used in evaluating the severity of the deformities; (2) methods used in evaluating outcomes of different treatments; (3) benefits of rhinoplasty performed at the time of the lip repair and evidence for the effect of rhinoplasties performed after infancy but before maturity; (4) presurgical orthopedics and nasoalveolar molding; (5) common surgical techniques used in primary cleft rhinoplasties; and (6) impact of the nasal deformity on quality of life. Overall, there is little high-level evidence regarding the outcomes of cleft nasal deformity treatment, leaving much room for future study. (*Plast. Reconstr. Surg.* 133: 1276, 2014.)

DEFINING CHARACTERISTICS OF CLEFT NOSE DEFORMITY

The cleft nose deformity has well-described characteristics for both unilateral and bilateral cleft[1–4] (**Reference 4 Level of Evidence: Diagnostic, IV**) (Table 1 and Fig. 1). (**See Video, Supplemental Digital Content 1**, which displays various nasal deformities, available in the "Related Videos" section of the full-text article on PRSJournal.com or, for Ovid users, at ***http://links.lww.com/PRS/A990***.) The goal of treatment is to restore symmetry in the unilateral cleft lip nose and to approximate normal anatomy in the bilateral cleft.

PREOPERATIVE AND POSTOPERATIVE ASSESSMENT OF THE SEVERITY OF THE CLEFT NOSE DEFORMITY

To make any accurate determination of the efficacy of the numerous treatment methods currently used, we need a uniform tool that assesses the severity of the initial deformity and provides objective evaluations of the results of treatment.

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

Supplemental digital content is available for this article. Direct URL citations appear in the text; simply type the URL address into any Web browser to access this content. Clickable links to the material are provided in the HTML text of this article on the *Journal*'s Web site (www.PRSJournal.com).

Table 1. Summary of Characteristics of Unilateral and Bilateral Cleft Nose Deformity

Unilateral
- Nose appears longer on cleft side
- Cleft-side dome retro-displaced
- Columella base deviated to noncleft side
- Cleft-side nostril is wider and retro-displaced
- Cleft-side nostril margin buckles inward because of bowing by internal vestibular web
- Cleft-side maxilla is deficient
- Cleft-side alar base and piriform margin displaced posteriorly and laterally
- Anterior nasal spine anterolaterally displaced
- Premaxilla, columella, and caudal septum deviated toward noncleft side
- Cleft-side dome of LLC is posterolaterally displaced
- Angle between medial and lateral crura on cleft side is increased
- Cleft-side medial crus is short; lateral crus is long
- Cleft-side ULC and LLC side-by-side instead of normal overlap

Bilateral
- Tendency toward symmetry
- Nose is wide; tip is broad and depressed
- Columella is short
- Nostrils are wide with margins buckling inward
- Alae are flared with vestibular webbing bilaterally
- Alar domes are posterolaterally displaced
- Angles between the medial and lateral crura are increased
- Medial crura are short; lateral crura are long
- Premaxilla is protrusive
- Maxilla is hypoplastic bilaterally
- Caudal septum and anterior nasal spine are displaced inferior relative to alar bases
- Nasal floor is absent

LLC, lower lateral cartilage; ULC, upper lateral cartilage.

The assessment tool should also be simple enough so that most centers can easily collect data. Outcomes studies can then compare treatment protocols, techniques, and even individual surgeons. Comparisons should be linked to the severity of the cleft to make them really meaningful.

Currently, the studies of cleft nose deformities report new techniques and protocols and compare them either to retrospective cohorts within their own centers or to standardized norms. Very few studies compare techniques and protocols to those of other centers. Most studies use their own unique assessments, making comparisons even more difficult. A few studies have matched outcomes to the cleft type and severity, but none has done so convincingly.[5]

Al-Omari et al. reviewed the assessments currently used for assessing the cleft-related facial deformities.[5] Very few have been devoted solely to assessing the cleft nose. The severity of the nasal deformity is dependent entirely on the severity of the cleft itself, and for this reason, most assessments of long-term outcomes perform overall nasolabial assessments rather than assessing the nose and lip independently.

In a study of the unilateral cleft nose, Fisher et al. demonstrated a strong correlation between the assessments of expert cleft surgeons and non-experts on the severity of the nasal deformity.[4] The study identified the columellar angle and nostril width ratio as two measures that correlate with the severity of the nasal deformity. Fisher et al. made the plea that these measures should be recorded routinely, as they will afford a basis for judging outcomes (Fig. 2).

Anthropometric data collected from live subjects or from facial casts allow direct measurements that can then be compared with anthropometric norms.[6] Garfinkle et al.[7] used this in a study of bilateral clefts where select points were chosen for anthropometric analysis at various time points in the patients' lives. The values were then compared with Farkas norms, effectively rating the outcome of select anthropometric points against those for children of the same age (**Reference 7 Level of Evidence: Therapeutic, IV**). Anthropometric analyses provide compelling data but still suffer from the limitation of choosing isolated points to effectively represent the aesthetic outcome of the entire nasolabial region. It is still possible for a patient to approximate anthropometric norms and carry the stigmata of a "cleft nose."

Subjective or qualitative assessments using standardized photographs analyzed by a panel of

Fig. 1. (*Left*) Unilateral cleft nose deformity. (*Right*) Bilateral cleft nose deformity.

Video 1. Supplemental Digital Content 1, which displays various nasal deformities, is available in the "Related Videos" section of the full-text article on PRSJournal.com or, for Ovid users, at *http://links.lww.com/PRS/A990*.

judges have been shown by Asher-McDade et al.[8] to provide valid, reliable, and reproducible ratings of cleft patients (**Reference 8 Level of Evidence:** **Diagnostic, IV**). Acknowledging that it is difficult, if not impossible, to separate the lip from the nose in a cleft assessment, this rating uses cropped, standardized, nasolabial photographs. The Asher-McDade rating is the tool used for nasolabial outcomes in the multicenter Eurocleft and Americleft studies.[8,9] This method of rating has been the subject of justifiable criticism for not being objective. Assessments that include three-dimensional data from laser or computed tomographic scans combined with animated recordings from videos undoubtedly allow much better discrimination in assessing results. Every center should be encouraged to collect as many sophisticated data as possible in anticipation of developing an objective, universally accepted assessment tool. Until then, with the photographs that are part of the patient record at a majority of centers, it is still possible to gather valuable information about treatment outcomes using qualitative assessments as the Eurocleft and Americleft studies have demonstrated.

Fig. 2. Fisher et al. showed that experts are able to reliably rank individual patients based on their subjective estimates of the cleft lip nasal deformity. The nostril width ratio and the angle of the columella from the sagittal plane increase with the subjective perception of the deformity. These two simple measures are useful as independent and objective indicators of presurgical severity of the unilateral cleft lip nasal deformity. (Reprinted 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.)

Kuijpers-Jagtman et al. demonstrated further utility in a study where a panel of observers selected a reliable photographic reference for each point on the five-point ordinal scale of Asher-McDade et al. Photographic references like this selected by obtaining the mean scores of the judges make the rating tasks a lot easier (**Reference 10 Level of Evidence: Diagnostic, II**)[10] (Fig. 3).

A shortcoming of the Eurocleft and Americleft studies is that, although the same scale was used to assess outcomes from multiple centers, there were still insufficient data about the severity of the preoperative deformities to allow a meaningful conclusion of outcomes related to cleft severity. A number of studies have shown improved accuracy with assessments that rate overall appearance by performing side-to-side comparisons of the deformities and by increasing the number of raters.[4,5,11]

EARLY OR DELAYED NASAL SURGERY

The cleft nose deformity was not addressed at the time of the initial lip repair for many years. Critics cited adverse growth effects and questioned whether early surgery improved the appearance and function of the nose and whether there was any benefit to the child's emotional well-being.[12]

Evidence for an Effect of Early Surgery on Growth

This concern has largely been refuted by a number of studies showing no adverse growth effects in spite of extensive surgical dissection performed with the primary rhinoplasty.[13,14] Studies with the longest follow-up by McComb and Salyer have shown varying degrees of persistent nasal deformities but no adverse growth effects.[15–18]

Concerns about growth problems are even greater when the primary rhinoplasty includes a septoplasty. Authors who have routinely performed these septoplasties have not noted any negative growth effects (**Reference 19 Level of Evidence: Diagnostic, IV**).[19,20]

Evidence for Improved Nasal Outcomes

Cussons et al. in 1993 and Kim et al. in a 2004 study documented definite improvements when comparing primary rhinoplasty to patients who did not have a rhinoplasty at the time of lip repair.[21,22] A similar comparison with a 9-year follow-up by Brussé et al. did not show marked improvements in the nasal appearance. They nevertheless favored primary rhinoplasty because those patients required fewer revisions compared with patients who did not have a primary rhinoplasty (**Reference 23 Level of Evidence: Therapeutic, IV**).[23]

Most other publications of long-term results report improved outcomes without directly comparing the results to patients who did not have early nasal surgery. Nevertheless, the principle of performing a rhinoplasty at the time of the lip repair is now well established.

Operating on the deviated septum in unilateral clefts as part of the primary rhinoplasty has also been shown to be effective. In a large retrospective study, Anderl et al. asserted that the improved septal position was maintained into adulthood.[19] Gawrych and Janiszewska-Olszowska recently reported similar long-term improvement in a comparative study.[20]

Evidence for Improved Quality of Life

Kramer et al. demonstrated the negative impact that clefts have on school-age children and their families.[24,25] Mani et al. performed the only study that specifically looked at quality of life and satisfaction with nasal appearance in adults previously treated for cleft lip–cleft palate. They found that greater cleft width in infancy, female sex, and nasal airway obstruction were all associated with lower satisfaction with nasal appearance.[26] Klassen et al. performed an exhaustive review of all quality-of-life studies related to cleft lip–cleft palate and found that none of them used patient-reported outcomes, a deficiency that they will address in future studies.[27] At this time, although many surgeons are convinced of the benefit of early rhinoplasty, there is no high-level evidence that it improves quality of life.

USE OF PRESURGICAL ORTHOPEDICS, SPLINTS, AND NASOALVEOLAR MOLDING

Evidence for the Use of Splints

Splints made of silicone have occasionally been used preoperatively to mold the cleft nose, but they are mostly used postoperatively to improve the surgical result.[28,29] Yeow et al. showed that it was necessary to use the splint for at least 6 months postoperatively to ensure improvement.[30]

Evidence for Presurgical Orthopedics

In the 1970s, orthodontists developed techniques using acrylic plates to align the maxillary arch in both unilateral and bilateral clefts. This was performed either passively, by adjusting the
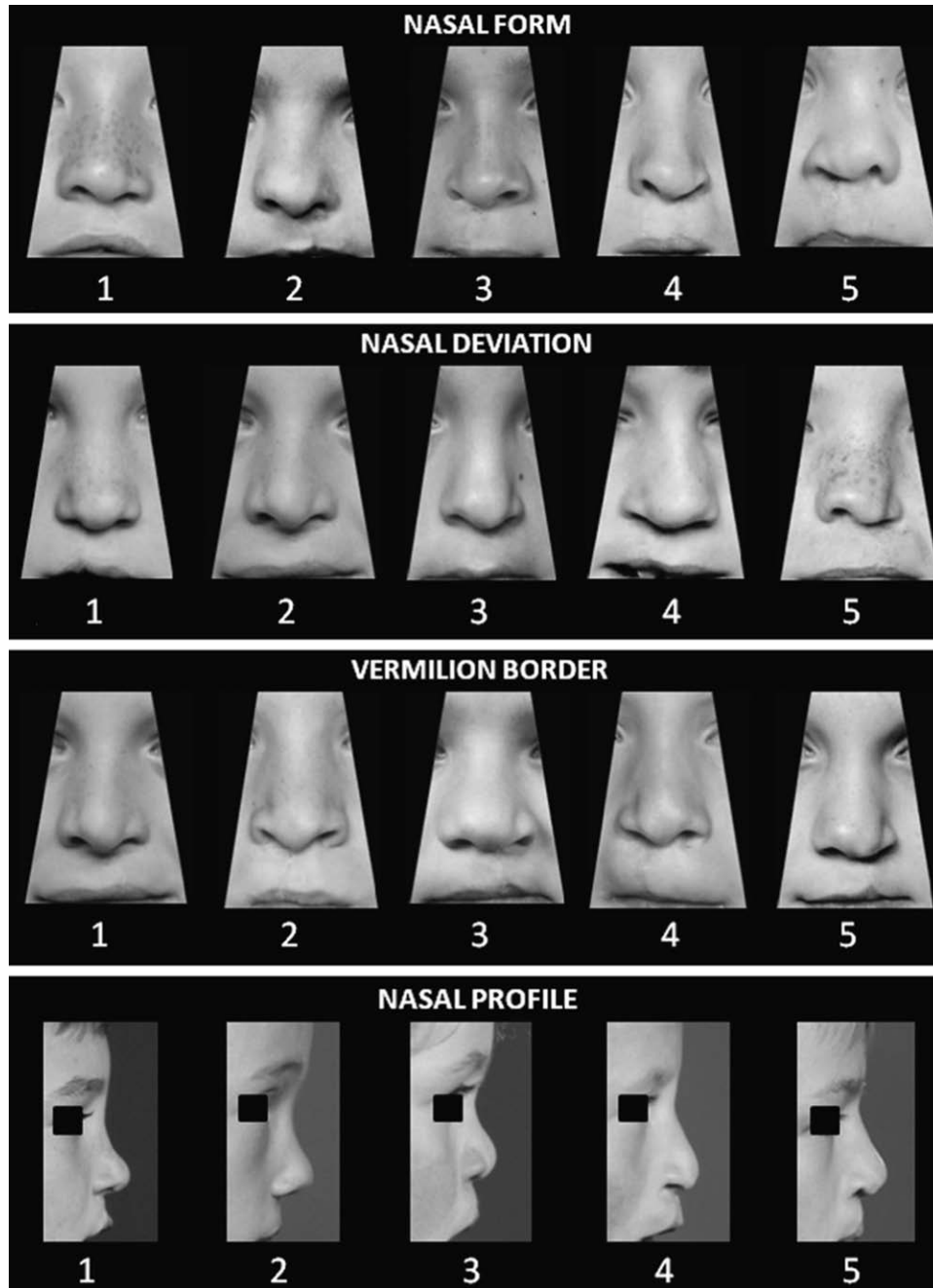
Fig. 3. Reference photographs developed for rating the nasolabial area in unilateral cleft lips. Nasal form, nasal deviation, the vermilion border and nasal profile are each rated on the ordinal scale described by Asher-McDade et al., where 1 = very good appearance, 2 = good appearance, 3 = fair appearance, 4 = poor appearance, and 5 = very poor appearance. (Reprinted with permission from Kuijpers-Jagtman AM, Nollet PJ, Semb G, et al. Reference photographs for nasolabial appearance rating in unilateral cleft lip and palate. *J Craniofac Surg.* 2009;20(Suppl 2):1683–1686.)

plate frequently to mold the arches; or actively, with a pin-retained appliance using jackscrews and elastic traction.[31,32]

Aligning the arch makes the subsequent lip repair easier. The preoperative nasal deformity is also improved. The cleft gap is narrowed and one or both nostril bases are repositioned by the movement of the underlying bone.

Evidence for Nasoalveolar Molding

The concept of presurgical nasoalveolar molding grew out of the marriage of presurgical

orthopedics and nasal molding. Grayson et al. helped develop and popularize nasoalveolar molding by adding a nasal extension made of acrylic to the palatal plate[33] (Fig. 4).

A number of studies have demonstrated improvement in the nasal deformity in the short term with nasoalveolar molding for both unilateral and bilateral clefts (**Reference 35 Level of Evidence: Therapeutic, IV**).[33–37] Nasoalveolar molding in unilateral clefts is reported to improve nostril height, axial orientation, length of the columella, and tip projection.[37] This improvement is maintained in longer term follow-up studies where nasoalveolar molding and non–nasoalveolar molding patients were compared (**Reference 38 Level of Evidence: Therapeutic, III**).[38,39] Bennun et al., in a prospective controlled trial, showed improvements in tip projection, columellar length, and nostril width in nasoalveolar molding patients compared with non–nasoalveolar molding patients up to 6 years after treatment (**Reference 40 Level of Evidence: Therapeutic, II**).[40] Liou et al., however, reported a significant relapse within the first year of the improvement gained from nasoalveolar molding in unilateral clefts.[35] Pai et al. reported a similar relapse in their patients (**Reference 41 Level of Evidence: Therapeutic, IV**).[41]

Nasoalveolar molding appears to be especially well suited to treating bilateral clefts. In addition to narrowing and repositioning the nostril bases, nasoalveolar molding lengthens the short columella, a vexing problem in bilateral clefts (**Reference 42 Level of Evidence: Therapeutic, III**).[33,42] Once again, the proponents report sustained long-term improvements and fewer nasal

operations when compared with a group that had nasal reconstruction with banked forked flaps.[43] The same center showed nearly normal anthropometric measurements in a group of 77 patients when compared with age-matched controls at 12 years of age.[7] The issue of early relapse is also apparent in the use of nasoalveolar molding with bilateral clefts. Liou et al. in another study showed a relative relapse in the columellar length gain 1 year after surgery.[36] In spite of the relapse, nasoalveolar molding does appear to improve nasal outcomes over non–nasoalveolar molding techniques. In a study of a single surgeon's experience, the best results were obtained when nasoalveolar molding was followed by a primary rhinoplasty that overcorrected the deformity at the time of the lip repair and when a silicone nasal splint was used postoperatively for 6 months.[44]

In a recent evidence-based literature review, Abbott and Mera concluded that there is evidence that nasoalveolar molding improves nasal outcomes in unilateral clefts but that, overall, there is a lack of high-level evidence supporting its efficacy (**Reference 45 Level of Evidence: Therapeutic, III**).[45]

More studies are still needed to assess long-term outcomes after nasoalveolar molding use. Comparative outcomes should determine whether nasoalveolar molding produces superior functional and aesthetic results and whether there is a reduction in the complexity and number of secondary rhinoplasty procedures. All of this needs to be weighed against the extra time and cost involved with nasoalveolar molding. Future Americleft studies that compare centers using nasoalveolar molding to those where primary
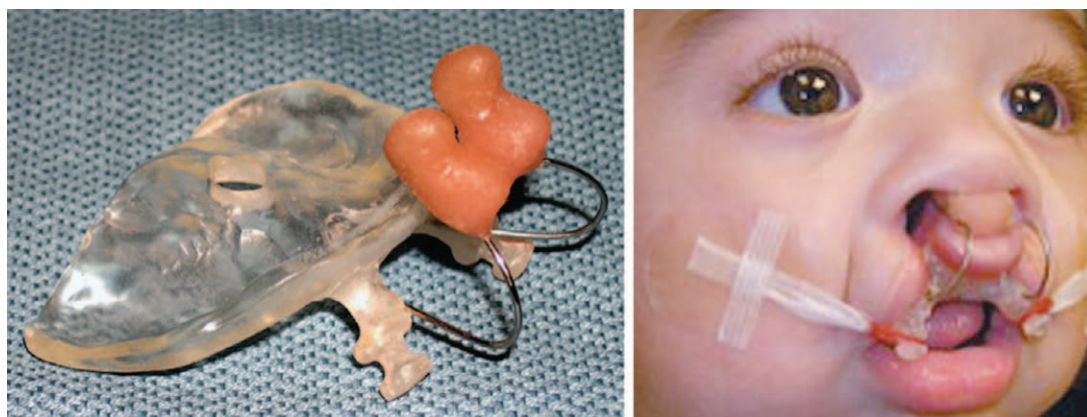

Fig. 4. (*Left*) Nasoalveolar molding appliance for bilateral cleft showing nasal extensions attached to the palatal plate. (*Right*) Nasoalveolar molding appliance in place. (Reprinted from Lee CT, Garfinkle JS, Warren SM, Brecht LE, Cutting CB, Grayson BH. Nasoalveolar molding improves appearance of children with bilateral cleft lip-cleft palate. *Plast Reconstr Surg.* 2008;122:1131–1137.)
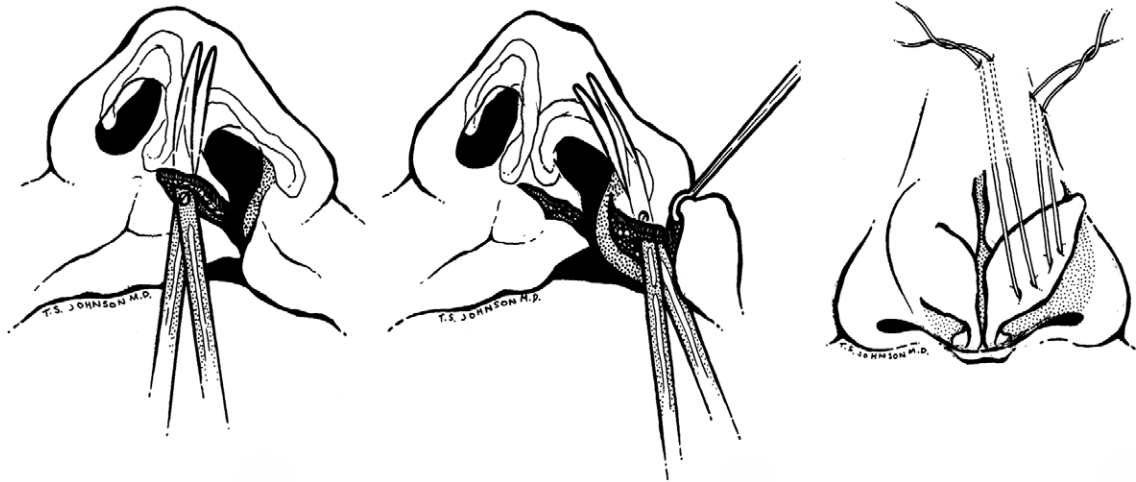
Fig. 5. McComb's technique. Tissue is freed up over the lower lateral cartilage with access from the lip repair incisions adjacent to the columella and nostril base. Sutures reshape and elevate the lower lateral cartilage.

rhinoplasty alone is performed will possibly provide the answers.

HISTORY OF EARLY SURGICAL TECHNIQUES

Repair of the cleft nose deformity performed with the primary lip repair has a relatively short history. Early proponents such as Gillies and Berkeley used direct open tip approaches to the cleft nose.[12] Erich used a distal gullwing shaped transcolumellar incision. All these techniques left a significant external scar.[46]

Early techniques manipulating the alar cartilages included dividing the lower lateral cartilage on the cleft side and securing the cut edge to the noncleft cartilage in an attempt to refine the tip.[47] Unfortunately, this distorted the tip. Techniques now focus on repositioning and reshaping the cleft side lower lateral cartilage.

TECHNIQUES FOR EARLY UNILATERAL CLEFT NOSE REPAIR

These can be conveniently grouped according to the incisions used.

Techniques Using Existing Cleft Lip Repair Incisions

In the 1970s, McComb introduced a technique where the nasal skin over the cartilages and nasal dorsum on the cleft side was undermined all the way to the nasion, which allowed independent movement of the cartilage.[48] Access for undermining is made by means of the cleft lip incisions from the base of the columella medially and the nostril base laterally. A curved pair of scissors or hemostat

is used. No additional incisions are made in the nose. Suspension sutures elevate and reshape the lower lateral cartilage (Fig. 5). (**See Video, Supplemental Digital Content 2**, which demonstrates the McComb rhinoplasty technique, available in the "Related Videos" section of the full-text article on PRSJournal.com or, for Ovid users, at ***http://links.lww.com/PRS/A991***.) Long-term follow-up of McComb's patients showed an improved nasal appearance compared with patients who did not have the nose addressed. Nasal deviation secondary to septal deviation was still seen.[15] Salyer et al. published similar long-term results.[14]

Techniques Using Additional Intranasal and Rim Incisions

Tajima described one of the most widely practiced primary rhinoplasty techniques using rim and
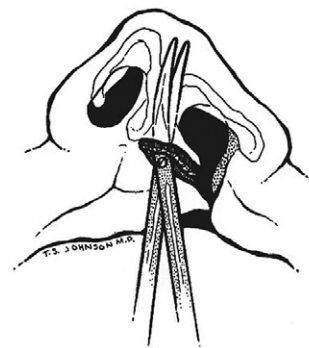
Video 2. Supplemental Digital Content 2, which demonstrates the McComb rhinoplasty technique, is available in the "Related Videos" section of the full-text article on PRSJournal.com or, for Ovid users, at ***http://links.lww.com/PRS/A991***.

Fig. 6. Tajima's technique. (*Left*) Incision commences intranasally from the junction of the columella and membranous septum, passes onto nostril skin in the region of the dome, and then back intranasally toward the web formed by the lower lateral cartilage laterally. The skin is undermined widely over the lower part of the nose. (*Center*) Sutures suspend the ipsilateral lower lateral cartilage to the contralateral lower lateral and upper lateral cartilages as illustrated. (*Right*) Once this is completed, the skin incision is closed. Skin resection is seldom required.

intranasal incisions (Fig. 6). A reverse U–shaped incision is made medially inside the nose at the junction of the columella and membranous septum. It traverses the nostril rim in the region of the dome and passes back intranasally toward the nostril web. The skin is undermined widely over the lower two-thirds of the nose and sutures are placed between the domes and from the cleft side lower lateral cartilage to the opposite and ipsilateral upper lateral cartilages. The incision is then closed without having to resect skin.[49]

A more extensive approach described by Ahuja uses an intercartilaginous incision laterally with a Tajima reverse–U incision medially. A rim incision on the opposite nostril allows for easier undermining and placement of intercartilaginous sutures[50] (Fig. 7).
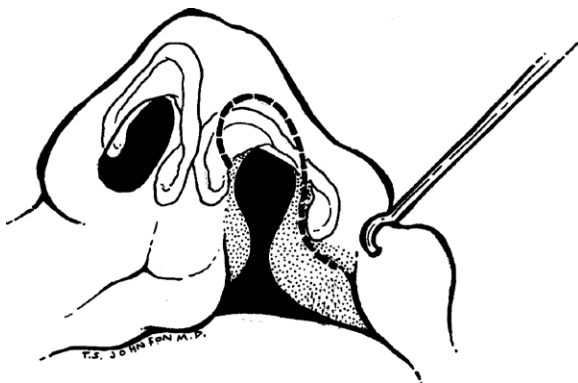

Fig. 7. Ahuja's technique. Access to the lower lateral cartilage is gained by means of a combination of an intercartilaginous incision laterally and a Tajima incision medially.

Techniques Using External Incisions and Open Rhinoplasty

Thomas described use of an open rhinoplasty technique at the time of a rotation-advancement lip repair in 255 patients with up to 13 years' follow-up. He reported easier dissection and repositioning of the cartilage framework and improved results over the closed technique[51] (Fig. 8).

Dibbell described a procedure using an extensive rim incision, wide mobilization, and rotation of the nostril. Originally described for late corrections, it has also been used in primary corrections[52] (Fig. 9).

A word of caution is warranted when using extensive circumferential incisions. There is a real risk of producing a cicatricial nostril stenosis (Fig. 10). The complication is not widely reported but certainly occurs and is very difficult to correct.

TECHNIQUES FOR EARLY BILATERAL CLEFT NOSE REPAIR

The main problems with the bilateral cleft nose deformity are a short columella, flattened nasal tip, and splayed nostril bases. The use of forked flaps to lengthen the columella was once a popular technique but has largely been abandoned. It produced a bulky, heavily scarred columella.

McComb changed from using forked flaps to an open rhinoplasty approach after a 15-year review of his cases. His new technique included an incision placed across the lower part of the
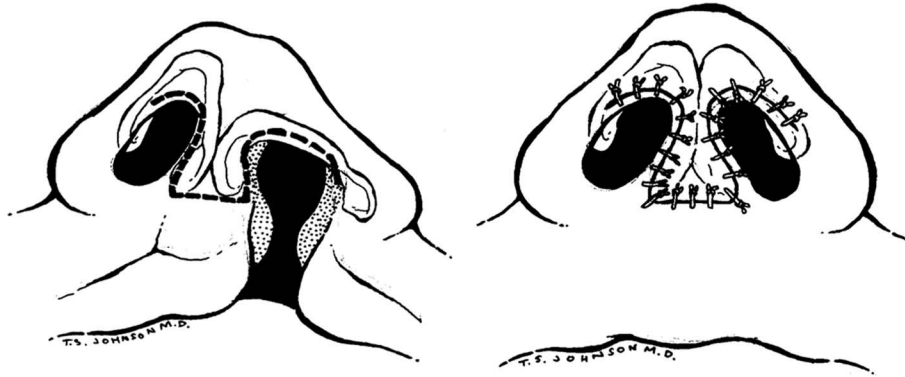
Fig. 8. Thomas' primary open rhinoplasty technique. A transcolumellar incision across the base of the columella continues intranasally as rim incisions bilaterally as shown in the diagram.
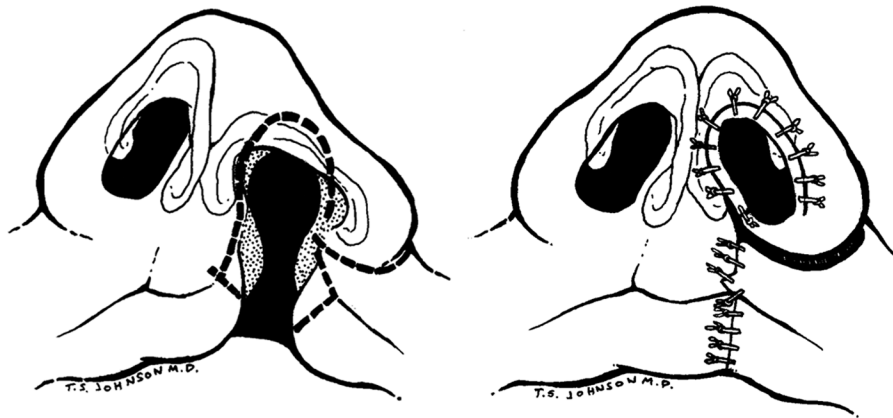

Fig. 9. Dibbell's procedure. (*Left*) The medial lip incision is continued superiorly along the columella, across the dome, and then laterally as a rim incision. The nostril is freed by and incision made around the base and continued medially. (*Right*) The entire nostril is rotated medially and superiorly as illustrated.

Fig. 10. Nostril stenosis in a patient who had circumferential intranasal incisions for the primary rhinoplasty.

nasal tip and continued laterally as rim incisions. This allows direct access to the alar cartilages. Long-term follow-up showed improved nasal form, which he felt justified the external scars[13] (Fig. 11).

Mulliken's emphasis of the "columella in the nose" has focused surgeons on developing techniques that produce a normal columella without external incisions. Mulliken approaches the nasal tip through bilateral rim incisions, and then places interdomal sutures and sutures elevating the alar cartilages to the upper lateral cartilages[53] (Fig. 12).

Trott and Mohan performed rim incisions that become continuous with and include elevation of the philtrum and columella as a single unit. The blood supply to the distal philtrum comes from the nasal dorsal skin[54] (Fig. 13).

Morovic and Cutting's approach is similar to Trott and Mohan's. The rim incisions connect with bilateral membranous incisions in the columella and continue distally to include the prolabium. The increased thickness of the columella improves the prolabial perfusion.[55]
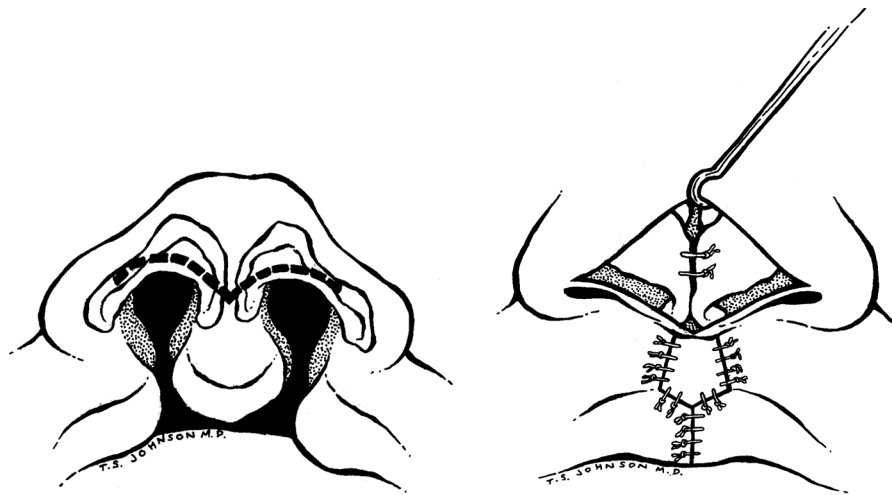
1284

Fig. 11. McComb's technique for bilateral cleft rhinoplasty. Bilateral rim incisions converge medially across the lower part of the nasal tip.

Each of these approaches allows access to the lower lateral cartilages and nasal tip. The excess tissue between the cartilages is dissected free from the cartilage and pushed superiorly, and interdomal sutures narrow the tip and improve projection. Additional sutures from the lower lateral cartilages to the upper lateral cartilages are used where necessary.

EARLY SEPTOPLASTY

Septoplasty as part of the early rhinoplasty is gaining acceptance as fears of growth disturbance are proven unfounded.[19,20] Veau, Delaire, and Talmant assert that nasal breathing is the driving force for normal maxillary growth. They feel that in addition to improved nasal form, primary rhinoplasty must also achieve a patent, functional nasal airway.[56] Gawrych and Janiszewska-Olszowska perform a limited septoplasty. The anterior attachment of the septum is released from the nasal spine and from the maxillary groove on the noncleft side and allowed to straighten out toward the side of the cleft. (**See Video, Supplemental Digital Content 3**, which demonstrates the septoplasty technique, available in the "Related Videos" section of the full-text article on PRSJournal.com or, for Ovid users, at ***http://links.lww.com/PRS/A992***. The anterior attachment of the septum is released from the nasal spine and from the maxillary groove on the noncleft side and allowed to straighten out toward the side of the cleft.) This simple maneuver had a long-lasting improvement where 83 percent of
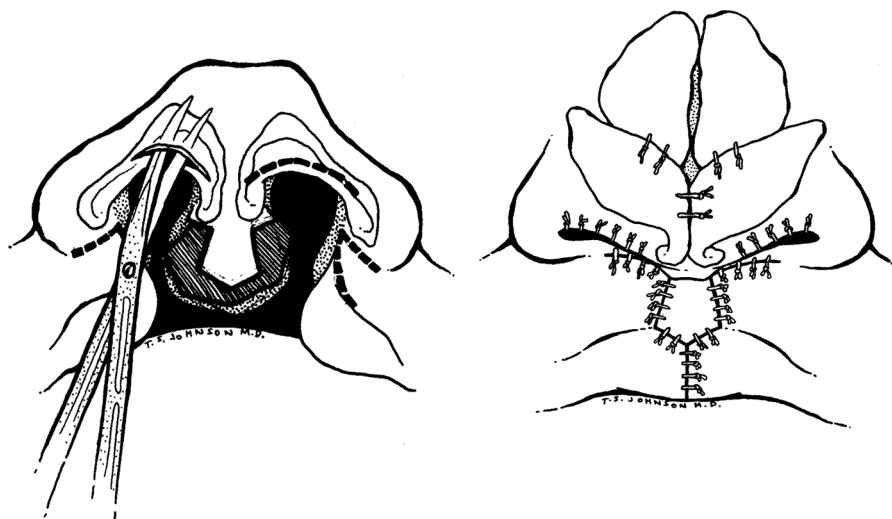

Fig. 12. Mulliken's technique. Bilateral rim incisions facilitate dissection of the lower lateral cartilages and placement of intercartilaginous sutures that reshape and elevate the nasal tip.
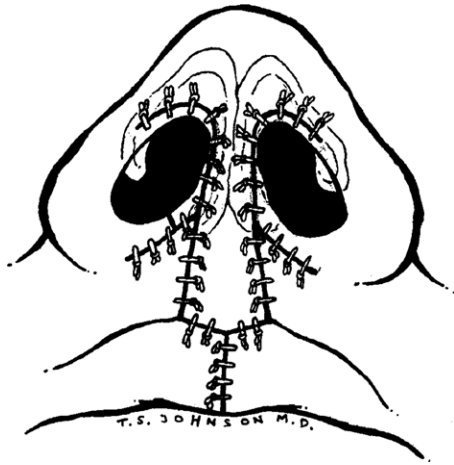
Fig. 13. Trott and Mohan's technique combining rim incisions that continue inferiorly to the prolabial lip incisions. The prolabium is pedicled off the columella and receives its blood supply from the nasal dorsum.

these patients had a straight septum 10 to 14 years after the primary operation compared with only 14 percent of a group of patients that had the same nasal operation without the septoplasty.[20] Gosla-Reddy et al. documented similar improvements, comparing two groups of 76 patients all operated on by a single surgeon.[57] However, the follow-up in this study was only 2 years. Ridgway et al. documented similar improvements in a comparative study with a 3- to 4-year follow-up.[58]

INTERMEDIATE RHINOPLASTY

Much of the literature on the cleft nasal deformity is concentrated on two time frames. The

Video 3. Supplemental Digital Content 3, which demonstrates the septoplasty technique, is available in the "Related Videos" section of the full-text article on PRSJournal.com or, for Ovid users, at *http://links.lww.com/PRS/A992*. The anterior attachment of the septum is released from the nasal spine and from the maxillary groove on the noncleft side and allowed to straighten out toward the side of the cleft.

first focuses on the primary rhinoplasty in early childhood and the second focuses on the definitive rhinoplasty where no rhinoplasty is offered until growth is complete. In contrast, many centers offer cleft rhinoplasties between these times. Not much is written regarding the intermediate period, and the literature does not offer a standardized approach. The residual deformities are highly variable and, much like the techniques for formal rhinoplasty, those used in this intermediate period vary considerably. Most surgeons perform less than a full rhinoplasty at the intermediate stage, focusing on repositioning and reshaping the lower lateral cartilages, whereas others advocate a full rhinoplasty with osteotomies and cartilage grafts.[59] Ortiz-Monasterio and Olmedo showed that a full rhinoplasty before 12 years produced results comparable to rhinoplasties performed after growth was complete.[60] Gosain and Fathi showed that using absorbable plates for alar and columella support at the intermediate stage preserved septal, rib, or conchal cartilage for the final rhinoplasty.[61]

One can see from the literature that there is an enormous variation in techniques and treatment protocols for the cleft lip nose. It is also obvious that lip surgery has a major effect on the nose. Surgeons today are more likely to think of the lip and nose as a unit. This approach has arguably improved not just early outcomes but also the final result. The improvements appear to last and, importantly, do so without adversely affecting growth.

The innovative techniques that have been developed need to be scrutinized. Long-term outcome studies comparing results from established cleft centers would definitely provide us with knowledge of best practices for all these patients. It is hoped that the Eurocleft and Americleft study groups will provide scientific evidence of best practices that go beyond the personal convictions that we surgeons so often profess.

Donald Mackay, M.D.
PennState Hershey Plastic Surgery500 University Drive,
UPC II, Suite 3200Hershey, Pa.17033
dmackay@hmc.psu.edu

PATIENT CONSENT

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

ACKNOWLEDGMENT

REFERENCES

1. Guyuron B. MOC-PS(SM) CME article: Late cleft lip nasal deformity. *Plast Reconstr Surg.* 2008;121:1–11.
2. Zbar RI, Canady JW. An evidence-based approach to secondary cleft lip nasal deformity. *Plast Reconstr Surg.* 2011;127:905–909.
3. Fisher DM, Sommerlad BC. Cleft lip, cleft palate, and velopharyngeal insufficiency. *Plast Reconstr Surg.* 2011;128:342e–360e.
4. Fisher DM, Tse R, Marcus JR. Objective measurements for grading the primary unilateral cleft lip nasal deformity. *Plast Reconstr Surg.* 2008;122:874–880.
5. Al-Omari I, Millett DT, Ayoub AF. Methods of assessment of cleft-related facial deformity: A review. *Cleft Palate Craniofac J.* 2005;42:145–156.
6. Farkas LG, Hajnis K, Posnick JC. Anthropometric and anthroposcopic findings of the nasal and facial region in cleft patients before and after primary lip and palate repair. *Cleft Palate Craniofac J.* 1993;30:1–12.
7. Garfinkle JS, King TW, Grayson BH, Brecht LE, Cutting CB. A 12-year anthropometric evaluation of the nose in bilateral cleft lip-cleft palate patients following nasoalveolar molding and cutting bilateral cleft lip and nose reconstruction. *Plast Reconstr Surg.* 2011;127:1659–1667.
8. Asher-McDade C, Brattström V, Dahl E, et al. A six-center international study of treatment outcome in patients with clefts of the lip and palate: Part 4. Assessment of nasolabial appearance. *Cleft Palate Craniofac J.* 1992;29:409–412.
9. Mercado A, Russell K, Hathaway R, et al. The Americleft Study: An inter-center study of treatment outcomes for patients with unilateral cleft lip and palate. Part 4: Nasolabial aesthetics. *Cleft Palate Craniofac J.* 2011;48:259–264.
10. Kuijpers-Jagtman AM, Nollet PJ, Semb G, Bronkhorst EM, Shaw WC, Katsaros C. Reference photographs for nasolabial appearance rating in unilateral cleft lip and palate. *J Craniofac Surg.* 2009;20(Suppl 2):1683–1686.
11. Asher-McDade C, Roberts C, Shaw WC, et al. Development of a method for rating nasolabial appearance in patients with clefts of the lip and palate. *Cleft Palate Craniofac J.* 1991;28:385–390.
12. Randall P. History of cleft lip nasal repair. *Cleft Palate Craniofac J.* 1992;29:527–530.
13. McComb H. Primary repair of the bilateral cleft lip nose: A 15-year review and a new treatment plan. *Plast Reconstr Surg.* 1990;86:882–889; discussion 890.
14. Salyer KE, Genecov ER, Genecov DG. Unilateral cleft lip-nose repair: A 33-year experience. *J Craniofac Surg.* 2003;14:549–558.
15. McComb HK, Coghlan BA. Primary repair of the unilateral cleft lip nose: Completion of a longitudinal study. *Cleft Palate Craniofac J.* 1996;33:23–30; discussion 30.
16. McComb HK. Primary repair of the bilateral cleft lip nose: A long-term follow-up. *Plast Reconstr Surg.* 2009;124:1610–1615.
17. Xu H, Salyer KE, Genecov ER. Primary bilateral one-stage cleft lip/nose repair: 40-year Dallas experience: Part I. *J Craniofac Surg.* 2009;20(Suppl 2):1913–1926.
18. Xu H, Salyer KE, Genecov ER. Primary bilateral two-stage cleft lip/nose repair: Part II. *J Craniofac Surg.* 2009;20(Suppl 2):1927–1933.
19. Anderl H, Hussl H, Ninkovic M. Primary simultaneous lip and nose repair in the unilateral cleft lip and palate. *Plast Reconstr Surg.* 2008;121:959–970.
20. Gawrych E, Janiszewska-Olszowska J. Primary correction of nasal septal deformity in unilateral clefts during lip repair: A long-term study. *Cleft Palate Craniofac J.* 2011;48:293–300.
21. Cussons PD, Murison MS, Fernandez AE, Pigott RW. A panel based assessment of early versus no nasal correction of the cleft lip nose. *Br J Plast Surg.* 1993;46:7–12.
22. Kim SK, Cha BH, Lee KC, Park JM. Primary correction of unilateral cleft lip nasal deformity in Asian patients: Anthropometric evaluation. *Plast Reconstr Surg.* 2004;114:1373–1381.
23. Brussé CA, Van der Werff JF, Stevens HP, et al. Symmetry and morbidity assessment of unilateral complete cleft lip nose corrected with or without primary nasal correction. *Cleft Palate Craniofac J.* 1999;36:361–366.
24. Kramer FJ, Gruber R, Fialka F, Sinikovic B, Schliephake H. Quality of life and family functioning in children with nonsyndromic orofacial clefts at preschool ages. *J Craniofac Surg.* 2008;19:580–587.
25. Kramer FJ, Gruber R, Fialka F, et al. Quality of life in school-age children with orofacial clefts and their families. *J Craniofac Surg.* 2009;20:2061–2066.
26. Mani MR, Reiser E, Andlin-Sobocki A, Skoog V, Holmström M. Factors related to quality of life and satisfaction with nasal appearance in patients treated for unilateral cleft lip and palate. *Cleft Palate Craniofac J.* 2013;50:432–439.
27. Klassen AF, Tsangaris E, Forrest CR, et al. Quality of life of children treated for cleft lip and/or palate: A systematic review. *J Plast Reconstr Aesthet Surg.* 2012;65:547–557.
28. Matsuo K, Hirose T, Otagiri T, Norose N. Repair of cleft lip with nonsurgical correction of nasal deformity in the early neonatal period. *Plast Reconstr Surg.* 1989;83:25–31.
29. Matsuo K, Hirose T. Preoperative non-surgical over-correction of cleft lip nasal deformity. *Br J Plast Surg.* 1991;44:5–11.
30. Yeow VK, Chen PK, Chen YR, Noordhoff SM. The use of nasal splints in the primary management of unilateral cleft nasal deformity. *Plast Reconstr Surg.* 1999;103:1347–1354.
31. Maisels DO. The influence of pre-surgical orthodontic treatment upon the surgery of cleft lip and palate. *Br J Orthod.* 1974;1:15–20.
32. Georgiade NG, Latham RA. Maxillary arch alignment in the bilateral cleft lip and palate infant, using pinned coaxial screw appliance. *Plast Reconstr Surg.* 1975;56:52–60.
33. Grayson BH, Cutting C, Wood R. Preoperative columella lengthening in bilateral cleft lip and palate. *Plast Reconstr Surg.* 1993;92:1422–1423.
34. Grayson BH, Cutting CB. Presurgical nasoalveolar orthopedic molding in primary correction of the nose, lip, and alveolus of infants born with unilateral and bilateral clefts. *Cleft Palate Craniofac J.* 2001;38:193–198.
35. Liou EJ, Subramanian M, Chen PK, Huang CS. The progressive changes of nasal symmetry and growth after nasoalveolar molding: A three-year follow-up study. *Plast Reconstr Surg.* 2004;114:858–864.
36. Liou EJ, Subramanian M, Chen PK. Progressive changes of columella length and nasal growth after nasoalveolar molding in bilateral cleft patients: A 3-year follow-up study. *Plast Reconstr Surg.* 2007;119:642–648.
37. Gomez DF, Donohue ST, Figueroa AA, Polley JW. Nasal changes after presurgical nasoalveolar molding (PNAM) in the unilateral cleft lip nose. *Cleft Palate Craniofac J.* 2012;49:689–700.
38. Barillas I, Dec W, Warren SM, Cutting CB, Grayson BH. Nasoalveolar molding improves long-term nasal symmetry in complete unilateral cleft lip-cleft palate patients. *Plast Reconstr Surg.* 2009;123:1002–1006.
39. Kozelj V. Experience with presurgical nasal molding in infants with cleft lip and nose deformity. *Plast Reconstr Surg.* 2007;120:738–745.

40. Bennun RD, Perandones C, Sepliarsky VA, Chantiri SN, Aguirre MI, Dogliotti PL. Nonsurgical correction of nasal deformity in unilateral complete cleft lip: A 6-year follow-up. *Plast Reconstr Surg*. 1999;104:616–630.

41. Pai BC, Ko EW, Huang CS, Liou EJ. Symmetry of the nose after presurgical nasoalveolar molding in infants with unilateral cleft lip and palate: A preliminary study. *Cleft Palate Craniofac J*. 2005;42:658–663.

42. Cutting C, Grayson B, Brecht L, Santiago P, Wood R, Kwon S. Presurgical columellar elongation and primary retrograde nasal reconstruction in one-stage bilateral cleft lip and nose repair. *Plast Reconstr Surg*. 1998;101:630–639.

43. Lee CT, Garfinkle JS, Warren SM, Brecht LE, Cutting CB, Grayson BH. Nasoalveolar molding improves appearance of children with bilateral cleft lip-cleft palate. *Plast Reconstr Surg*. 2008;122:1131–1137.

44. Chang CS, Por YC, Liou EJ, Chang CJ, Chen PK, Noordhoff MS. Long-term comparison of four techniques for obtaining nasal symmetry in unilateral complete cleft lip patients: A single surgeon's experience. *Plast Reconstr Surg*. 2010;126:1276–1284.

45. Abbott MM, Meara JG. Nasoalveolar molding in cleft care: Is it efficacious? *Plast Reconstr Surg*. 2012;130:659–666.

46. Erich JB. A technic for correcting a flat nostril in cases of repaired harelip. *Plast Reconstr Surg*. 1952;12:320–324.

47. Byers LT. Surgical correction of nasal deformities. *Surg Gynecol Obstet*. 1947;84:65–78.

48. McComb H. Treatment of the unilateral cleft lip nose. *Plast Reconstr Surg*. 1975;55:596–601.

49. Tajima S. Follow-up results of the unilateral primary cleft lip operation with special reference to primary nasal correction by the author's method. *Facial Plast Surg*. 1990;7:97–104.

50. Ahuja RB. Primary definitive nasal correction in patients presenting for late unilateral cleft lip repair. *Plast Reconstr Surg*. 2002;110:17–24.

51. Thomas C. Primary rhinoplasty by open approach with repair of unilateral complete cleft lip. *J Craniofac Surg*. 2009;20(Suppl 2):1711–1714.

52. Dibbell DG. Cleft lip nasal reconstruction: Correcting the classic unilateral defect. *Plast Reconstr Surg*. 1982;69:264–271.

53. Mulliken JB. Primary repair of bilateral cleft lip and nasal deformity. *Plast Reconstr Surg*. 2001;108:181–194; examination 195.

54. Trott JA, Mohan N. A preliminary-report on open tip rhinoplasty at the time of lip repair in unilateral cleft-lip and palate: The Alor Setar experience. *Br J Plast Surg*. 1993;46:363–370.

55. Morovic CG, Cutting C. Combining the Cutting and Mulliken methods for primary repair of the bilateral cleft lip nose. *Plast Reconstr Surg*. 2005;116:1613–1619; discussion 1620.

56. Talmant JC. Nasal malformations associated with unilateral cleft lip: Accurate diagnosis and management. *Scand J Plast Reconstr Surg Hand Surg*. 1993;27:183–191.

57. Gosla-Reddy S, Nagy K, Mommaerts MY, et al. Primary septoplasty in the repair of unilateral complete cleft lip and palate. *Plast Reconstr Surg*. 2011;127:761–767.

58. Ridgway EB, Andrews BT, Labrie RA, et al. Positioning the caudal septum during primary repair of unilateral cleft lip. *J Craniofac Surg*. 2011;22:1219–1224.

59. Stal S, Hollier L. Correction of secondary deformities of the cleft lip nose. *Plast Reconstr Surg*. 2002;109:1386–1392; quiz 1393.

60. Ortiz-Monasterio F, Olmedo A. Corrective rhinoplasty before puberty: A long-term follow-up. *Plast Reconstr Surg*. 1981;68:381–391.

61. Gosain AK, Fathi AH. Assessment of secondary cleft rhinoplasty using resorbable plates at the age of primary school. *J Craniofac Surg*. 2009;20(Suppl 2):1801–1805.