Residual deformities after repair of clefts of the lip and palate

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Patients with clefts of the lip or palate require a number of procedures to achieve complete habilitation. Refinements in cleft care, improved treatment protocols and techniques, and a better understanding of the timing and rationale for each procedure have resulted in a significant reduction of the average number of procedures. Other reasons for reduction include elimination of some surgical techniques because of suboptimal long-term results or high rates of complications and the use of newer modalities and techniques that effectively assist in correcting the majority of deformities associated with clefts of the lip and palate. Despite this progress, there is a need for additional operations. Subsequent operations are necessary to correct residual, functional, and aesthetic deformities that were not addressed during the initial procedure, inherent tissue deficiencies, maxillofacial changes, and scar contractures. Revisions are necessary to manage and correct unfavorable results from errors in technique or complications of the initial procedures. A number of additional procedures are also necessary to manage otologic, dental, and speech problems.

The average total number of surgical procedures necessary to achieve the best possible functional and aesthetic habilitation for patients born with cleft lip or palate has not been defined and is difficult to estimate from existing data. Only a few retrospective studies are available, analyzing a relatively small sample of patients. In some studies, secondary procedures, such as alveolar bone grafts and orthognathic surgery, are barely mentioned or included, and most studies do not include necessary dental or otologic procedures in the total average number of procedures. Thus, the total number of procedures is under-reported. Yet, this information is important when consulting with the families of patients with clefts and establishing a short- and long-term plan for care of infants with clefts. It is also important when discussing care of these patients with referring physicians and third-party payers.

Recently, Mackay et al [1] reported a retrospective study of 374 patients with clefts and a follow-up of 15 years on average. Patients underwent an average of 3.3 reconstructive procedures and 1.2 otolaryngologic procedures. Cohen et al [2] evaluated 67 consecutive patients over the age of 14 with unilateral and bilateral clefts of the lip and palate and reported an average number of 6.12 procedures for patients with unilateral and 8.04 procedures for patients with bilateral cleft lip and palate. Bardach et al [3] evaluated 45 children with unilateral cleft lip and palate and reported an average of 1.82 revisions per patient. They also evaluated 50 patients, 5 to 10 years of age (\(n = 20\)) and 11 to 29 years of age (\(n = 30\)). Multiple additional procedures were necessary in both groups [4]. Furthermore, only 23\% of the older patients were judged to have had completed treatment by the surgeon, speech pathologist, or orthodontist. The authors conclude that “It is very difficult to state whether the results obtained by our team can be considered satisfactory, because there are no comparable studies that have attempted to evaluate the same
parameters in multidisciplinary management. There is a definite need for more data to identify the major problems in the treatment of patients with cleft.

There is agreement that, in addition to the repair of the cleft lip and cleft palate, several procedures are necessary until these babies reach adulthood to achieve near normal functional, aesthetic and psychological results, and complete habilitation. This article describes the most common residual deformities after cleft lip and cleft palate repair and suggests treatment with time-honored procedures.

Residual deformities of the lip

Residual deformities of the lip after repair of unilateral or bilateral clefts are not uncommon [5]. A revisional lip surgery is an elective procedure and should be scheduled only after extensive consultation with the parents and the child or adolescent. Objectives of the procedures, the surgical plan, and the possible outcome should be outlined. False expectations should be dispelled. Timing for the procedure can affect outcome and should be taken into consideration. Surgical procedures should be postponed if the adolescent refuses to have an additional procedure even when parents ask for it. On the other hand, some procedures might be scheduled earlier than initially planned, when there is evidence of a negative psychological effect of the residual deformity on the patient. Finally, procedures should be bundled together to reduce time away from school or work, to reduce the additional psychologic trauma associated with multiple interventions, and to control cost.

Correction of residual lip deformities

Residual lip deformities might vary significantly in severity from minor deformities that require limited procedures for correction to major asymmetries and deformities that require complete redo of the lip repair. Such deformities result from errors of planning and technique or are due to inherent tissue deficiencies, maxillofacial changes, or scar contractures. The entire lip, alveolus, and nose should be carefully evaluated at rest and during animation before each revision. The deformity should be analyzed, and all contributing factors should be taken into consideration. All necessary landmarks should be well marked and measured, and each procedure should be planned to specifically address the residual deformity. Careful planning and appropriate timing and execution are important because failure of the revisionary procedure to correct the deformity results in additional scarring and possible further tissue loss that could reduce the chances for adequate habilitation [6].

Scars

Wide, poorly healed scars of the upper lip with unsightly stitch marks across the scar are primarily caused by technical errors such as poor handling of the tissues, closure under tension, use of large sutures tightly tied, and sutures being left in place for too long. Such problems can be avoided in the majority of cases with the use of basic plastic surgery techniques, meticulous tissue handling, and a tension-free closure with fine suture material. Other aggravating factors for scarring include perioperative bleeding, infection, and dehiscence. One should be able to differentiate these unsightly scars from the hypertrophic scars that form without apparent cause. Such scar hypertrophy usually fades away slowly several months or years after the lip repair without the need for additional surgical intervention.

Timing for scar revision is important to the final outcome. The surgeon should wait for at least several months or several years and should allow for the scar to mature before beginning revision. After careful evaluation of the problem, appropriate surgical procedures should be planned. Elliptical excision of the scar, precise re-approximation, and closure after limited undermining at the level above the orbicularis oris is the simplest solution. This technique, however, can only be applied for relatively narrow scars. Excision of wider scars might result in defects that, if closed primarily, result in undue tension and tightness across the lip and narrowing of the nostril sill. The surgeon needs to appropriately rearrange the tissues on either side of the scar with Z-plasties or wave-lines to avoid these unfavorable results. Dermabrasion can be helpful in selected cases, although the use of this technique is limited and primarily recommended for improvement of residual surface irregularities. Micro-hair transplantation can also be considered in men to camouflage hair-bearing lip scars [7].

Mucocutaneous deformities

Mucocutaneous deformities are seen in the mucocutaneous junction and result from poor alignment of the white roll during the initial lip repair. They can be corrected primarily with an elliptical or rhomboid excision of the scar and accurate re-approximation of the mucocutaneous junction. Alternatively, a small Z-plasty can be used to allow for interposition of
Vermilion and labial sulcus deformities

Lack of bulk or poor alignment of the vermilion can cause several deformities. Lack of bulk is primarily caused by inherent tissue deficiency, inappropriate planning, and dehiscence or failure to approximate the lower portion of the orbicularis oris muscle during the initial lip repair. To correct these deformities, the scar of the vermilion border should be incised or excised, and the orbicularis muscle fibers should be identified after limited undermining and approximated with absorbable sutures. The mucosa and vermilion should then be approximated carefully with eversion of the margins. If additional bulk is needed, small local filler grafts can be used. Such fillers include de-mucosalized or subcutaneous tissue flaps and autogenous fascial or fat grafts. For more significant deficiencies of the vermilion, a cross lip flap as described by Kawamoto [9] could provide superior result. Care should be taken to avoid over-correction, which causes an equally unsightly deformity.

Small whistling deformities of the lip resulting primarily from scar contracture in the area of the vermilion and the mucosa of the lip can be corrected with Z-plasties by placing the central limb of the Z on the existing scar. A central whistling deformity with adequate length of the lateral lip segments is seen primarily after repair of bilateral clefts. Several techniques have been described to correct this deformity and establish lip harmony. Local tissue rearrangement with various techniques including free grafts [10], bilateral pendulum flaps [11], or the use of mucosal-submucosal flaps [12] can be used with reasonably good outcome.

Excessive redundancy of the mucosa and the vermilion is not uncommon after unilateral cleft lip repair. As long as the rest of the lip is normal, the deformity can be corrected with an elliptical or inverted T excision of the excess tissue. Excision of too much tissue results in a flat and deficient vermilion.

In several instances, scar contractures extend to the oral mucosa and labial sulcus (Fig. 1). These contractures need to be released because, in most cases, they contribute to the retraction of the lip margin. Release can be achieved in most cases with various Z-plasties of V to Y designs that allow for the lip to unfold to a more normal position. Mucosal or skin grafts are unnecessary in most cases. Every effort should be made to obtain full mucosa re-approximation because any raw surface heals by secondary intention and results in further scar contracture and deformity. In bilateral clefts of the lip, the soft tissue requirements in the area of the upper labial sulcus might be different, and patients might present with an absent or significantly deficient sulcus. The lip appears short and retracted with show of the incisors and the premaxilla. Complete release of the soft tissues from the premaxilla is necessary to correct this problem. If relatively small defects are created after the release, coverage can be achieved with local mucosal flaps. When the defect is relatively large, the raw area needs to be resurfaced with a skin or mucosal graft. To achieve a successful outcome, avoid denuding the premaxilla from its periosteum, suture the graft in place, and stabilize it with a small stent for 2 to 3 weeks. This deformity can be prevented in most cases, with appropriate lining of the premaxilla with a mucosal flap and creation of the upper buccal sulcus at the time of the initial lip repair.

Muscular deformities

Reconstruction of the orbicularis oris muscle is incorporated in the vast majority of unilateral and bilateral cleft lip repair techniques. Failure to reconstruct the muscular sling or partial/complete dehiscence of the muscle repair results in unsightly bulging of the muscle on either side of the lip scar, depressions, and asymmetries that are further accentuated during animation and give the lip an unnatural look (Fig. 2). For small deformities, the lip scar can be excised, and the muscle fibers can be identified after undermining from their abnormal attachments and sutured together without tension. When a more significant deformity exists, such as the one seen in some bilateral repairs requiring skin and mucosal excision in addition to the muscle realignment and approximation, then a total lip repair should be planned, and all elements of the lip should be repositioned in the correct position. Special attention should be given to the width and length of the philtrum in rapport to the lateral lip segments (Fig. 3).

Long upper lip

An excessively long lip can be technique related. Techniques such as LeMesurier and the initial Tennison design resulted in long lips. Correction of such deformities is difficult. If the discrepancy is not significant, it can be corrected with an appropriate tissue excision just below the nostril sill. If a significant deformity is present, then the old scar should be excised and the lip should be completely divided and
Fig. 1. (A) Short, deficient vermillion and poor alignment of the orbicularis oris muscle, which is bulging lateral to the lip scar. (B) Proposed incision for correction of the deformity. (C) Intraoral scaring and contracture accentuates the deformity. (D) Final result 3 years after correction of all elements of the deformity. (E) Intraoral view after release of contracture.
repaired again. Asymmetric deformities after bilateral cleft lip repair present a more complex problem. Unless the deformity is minimal, a total lip repair is required for correction. After appropriate measurements and excision of all excess tissues, reconstruction of the upper lip should be undertaken with accurate approximation of all anatomic layers.

Fig. 2. (A) Residual lip and nasal deformity after repair of unilateral cleft lip and palate and poor alignment of the orbicularis oris muscle, lack of bulk and projection of the vermillion around the scar, depression and scaring of the nostril sill, lateral deflection and depression, and asymmetry of the nostril. (B and C) Complete dehiscence of the orbicularis oris muscle was identified during surgery. The muscle was completely released and approximated without tension. (D and E) Final result after correction of the lip and nasal deformities.

Short upper lip

A short lip results primarily from straight-line closure or from inadequate rotation and advancement techniques. Small discrepancies might also result from scar contractures. They can be corrected with elliptical or diamond-shaped excisions or excisions of
the entire scar and closure after minimal undermining. If additional length is needed, Z-plasties can be designed and incorporated with the repair. If a significant discrepancy exists, then the only solution is to redo the lip repair. A contributing factor to a short lip deformity might be a contracture of a mucosal flap. When such contracture is present, it should be released.

**Tight upper lip**

Tight upper lip is encountered primarily in patients with bilateral clefts with soft tissue deficiency, but it can also be seen in some severe unilateral cases. The most appropriate solution is the addition of tissue from the lower lip. Because of the nature of the procedure and the temporary attachment of the lips, this procedure is not recommended for very young children. Accurate placement of the flap in the center of the lip is important to place the final scars on the area of the philtrum columns. The dimensions of the flap should be planned to fit well in the upper lip, to release the tightness, and to provide a balanced profile (Fig. 4).

In the unilateral cases, placement of the flap in the location of the lip scar can correct the tightness but does not significantly improve the appearance of the lip. Millard [13] recommended the placement of midline Abbe flaps in unilateral clefts, as with bilateral clefts. After the release of the tightness of the lip, a revision of the initial scar, if needed, could provide for even superior results.

**Palatoplasty failures**

Despite advances in palatoplasty techniques, knowledge gained from longitudinal studies, and a better understanding of the effects of palatoplasty on speech and facial growth, a number of patients need additional surgery to correct complications after re-
pair, including dehiscence and fistulas. Procedures designed to improve speech and correct skeletal deformities are discussed elsewhere in this issue.

Early dehiscence, particularly in the posterior third of the soft palate, is uncommon and is primarily caused by errors in technique that include inadequate mobilization and closure under tension or injury of the repair at reintubation. If dehiscence is recognized early, it should be repaired immediately to allow for early habilitation. Late correction of palatal dehiscence requires freshening up the margins of the dehiscence and remobilizing of the palatal flaps with further dissection to achieve a tension-free closure.

The incidence of palatal fistula formation after palatoplasty varies according to various studies from 0% to 63%. Most of these studies are misleading because they include patients managed with older techniques. Furthermore, some authors include in their analysis fistulas anterior to the alveolus that were left intentionally unrepaired at the time of palatoplasty and palatal dehiscences [14,15]. Thus, the overall incidence of fistulas reported in these studies does not necessarily reflect the accepted incidence of palatal fistulas, which ranges from 3% to 5% [16,17]. These numbers are closer to what most surgeons anticipate in their practice, regardless of

Fig. 4. (A) Very short and tight upper lip after repair of bilateral cleft lip. (B) Markings for a proposed Abbe flap from the lower lip. (C and D) Final result 4 years after reconstruction with improved balance and symmetry of the lip.
surgical technique, age at the time of repair, or width of the cleft.

Palatal fistulas represent failure of surgical technique. They might be caused by several factors, including poor selection of technique and design of palatoplasty. Problems in execution of the surgical procedure include incomplete dissection of the flaps, failure to adequately release the muscles from their abnormal attachment on the hard palate, poor handling of the tissues, closure under tension, failure to achieve a layered closure in the soft and in the hard palate, and postoperative bleeding or infections. Fistulas may present a few days after the palatoplasty or several years later at the time of orthodontic treatment and arch expansion. Some small fistulas might close spontaneously, but the vast majority of fistulas do not. Fistulas may become symptomatic, resulting in nasal regurgitation of saliva and food particles, the collection of food within the fistula, and halitosis; they might also affect speech, resulting in hyponasality, nasal emission, and articulation problems. The size of the fistula does not necessarily correlate with the effects on speech; even small fistulas (4.5 mm) can have negative effects on speech [18].

Repair of palatal fistulas used to carry a high rate of failure. More recent studies describe a high rate of success [19]. Clinical evaluation of each fistula, analysis of the possible causes, and appreciation of the availability of adequate soft tissue for the repair has allowed us to achieve a high rate of success and to significantly reduce the possibility of recurrence.

Established fistulas should be closed as soon as possible to prevent regurgitation, improve speech, and aid oral hygiene. There are exceptions, such as a patient who presents with a symptomatic palatal fistula in the hard palate and collapse of the maxillary segment. In such a case, an obturator should be used, and definitive fistula closure should be deferred for after completion of arch expansion.

Each area of the palate presents with different requirements in terms of fistula closure. The surgeon should first decide if the available surrounding tissues are adequate for a tension-free functional closure or if additional tissue is necessary, brought primarily from other areas of the oral cavity in the form of a flap. Distant pedicled and free flaps have been suggested for closure of difficult or recurrent fistulas when local tissues are not available. Such flaps are technically feasible but are seldom needed for the closure of palatal fistulas in cleft patients. One should also evaluate the movement of the soft palate and the possible inadequate dissection and mobilization of the muscles of the soft palate during the initial palatoplasty and speech before fistula closure (Fig. 5).

For patients presenting with adequate length and movement of the soft palate and a fistula in the area, a straightforward procedure of closure without extensive dissection is feasible in most cases. The margins of the fistula should be excised sharply and the palatal scar incised anteriorly and posteriorly to the fistula to allow for visualization and mobilization of the nasal lining and muscles around the fistula and a tension-free layered closure. This technique may not work for larger fistulas of the soft palate extending beyond the junction between hard and soft palate. Attempting to close the fistula after excision of its margins might result in undue tension at the suture line with subsequent failure. Further extension of the

Fig. 5. (A) Two fistulas in the soft palate, with significant impact on speech. Note the bulge of the muscles on either side indicating incomplete dissection during the initial palatoplasty. (B) Final result after complete mobilization and approximation of the muscles in the midline. There was an immediate improvement in speech after the repair.
incision in the hard palate and wide undermining of the palatal mucoperiosteum might facilitate closure. Relaxing lateral incisions might be necessary to achieve a tension-free closure.

A critical issue with repair of these fistulas is the adequacy of nasal lining because failure to repair the nasal surface of the palate might predispose to fistula recurrence. Small defects can be treated with a Z-plasty of the nasal lining flaps. Larger defects require the introduction of fresh tissue. In such cases, the buccal flap can provide adequate lining with well-vascularized tissue and can assist in the repair. Buccal flaps are easy, dependable, and have little morbidity and donor-site deformity [20]. Alternatively, a partial buccinator mucoperiosteal flap posteriorly based can be used [21].

A superiorly based pharyngeal flap can be used if the palate is relatively short and velopharyngeal insufficiency is present. One should first consider retropositioning of the palate at the time of fistula repair or the use of a pharyngeal flap to provide additional support of the plate repair in conjunction of the correction of the velopharyngeal insufficiency.

Fistulas of the hard palate present with a different challenge. Several surgeons have suggested the use of local turnover flaps from the periphery of the fistula for nasal lining closure [22] and the use of local rotation or transposition flap of palatal mucoperiosteum for oral coverage. These flaps can be successful when dealing with small defects. I prefer to redo the palatoplasty with complete mobilization of bilateral palatal flaps beyond the posterior margin of the fistula, identification and repair of the nasal lining directly or with the use of vomer flaps if needed, and approximation of the palatal flaps in the midline without tension. Even relatively large defects can be treated in this manner (Fig. 6).

Large anterior defects after multiple procedures and failures result in scarring and tissue stiffness, lack of elasticity, and hardness of the palatal tissues. Such fistulas may require management with additional tissue. Anteriorly based tongue flaps can be helpful for the management of such problems. The major drawbacks for this technique are the two stages necessary for completion of the reconstruction. Furthermore, this procedure might not be tolerated by young children. Eating and speaking are not significantly restricted during the period, and maxillomandibular fixation may not be necessary. With appropriate design and length of pedicle (5 to 6 cm), there is little chance of tethering and disruption of the suture line. A prerequisite for success is wide debridement of all scoured palatal tissues and suturing to well-vascularized tissue with mattress sutures. Closure of the nasal lining is of significance, although some surgeons have demonstrated repeatedly successful results without repairing the nasal lining.

Special attention should be given to large post-alveolar fistulas, particularly in patients with bilateral clefts. In such cases, there is a V-shaped defect between the premaxilla and the proper palate. Most of these defects are closed at the time of closure of oronasal fistulas and bone grafting of the alveolar cleft and of the maxilla. Closure of the alveolar fistulas with gingival mucoperiosteal tissue and the palatal defect with local flaps can be successful. Using labial or tongue flaps across the alveolus produces suboptimal results and an inferior habilitation because teeth cannot erupt through those tissues; the aesthetic outcome is also inferior. When the premaxilla protrudes excessively, the closure of the palatal fistula can be facilitated with setback of the premaxilla, simultaneous bone grafting of the alveolar defects, and soft tissue coverage with gingival mucoperiosteal

Fig. 6. (A) Large anterior palatal fistula after repair of a bilateral cleft lip and palate. (B) Final result. Complete closure was achieved with re-elevation of bilateral mucoperiosteal flaps. The nasal floor was closed with bilateral vomer flaps.
flaps anteriorly and palatal flaps posteriorly to the alveolar ridge [23].

**Correction of residual nasal deformities**

Over the last three decades, some surgeons have started using various techniques for simultaneous correction of the nasal deformity at the time of lip repair. They have presented promising long-lasting results without detrimental effects on facial or nasal growth [23,24]. As a result of their pioneering work, correction of nasal deformity is incorporated with the primary lip repair. Thus, children with facial clefts are given the opportunity to grow up with less psychological burden from the nasal deformity. Despite the use of these advanced early techniques, however, a number of patients require additional procedures to restore asymmetry and improve function. Minor revisions, when needed, are traditionally performed before the child enters school. On occasion, early septoplasties are necessary to relieve significant airway obstruction [25].

The severity of the residual nasal deformity varies depending on the severity of the initial deformity and the degree of previous correction of the nasal or maxillary deformities. Previous interventions and subsequent scarring might have produced additional “iatrogenic” deformities unique for each patient, which need to be taken into consideration during the evaluation and planning of the definitive corrective procedure.

Patients with clefts of the lip and palate suffer from varying degrees of nasal airway obstruction. Such obstruction is attributed to several factors, including the external nasal deformity and deviation, septal deviation, vomerine and maxillary bony spurs, turbinate hypertrophy, and a deficit in maxillary growth. Abnormal swelling of the nasal mucosa from constant irritation by saliva and food through an existing oronasal fistula further contributes to the obstruction. Finally, some patients with clefts might have pharyngeal flaps or palatoplasties in place. These structures might further decrease the size of the airway and increase airway resistance.

The treatment plan for correction of residual cleft nasal deformities should be individualized based on extensive evaluation and analysis of the existing deformity. All contributing factors to the deformity should be taken into consideration and every effort should be made to correct the aesthetic and the functional aspects of the deformity [26].

Definitive correction of the residual nasal deformity should be deferred until after orthodontic alignment of the maxilla; bone grafting of the residual alveolar cleft and the hypoplastic maxilla; and closure of the possibly co-existing oronasal, alveolar, or palatal fistulas. If a LeFort I osteotomy or other major maxillary procedure is necessary to correct occlusion and facial harmony, they should also be performed before the nasal surgery [27].

Preoperative evaluation should be extensive. At our center, we include the following:

- **Patient questionnaire:** A questionnaire is given to the patients and their families before surgery and after treatment. Detailed information about symptoms and signs of airway obstruction, allergies or other respiratory and general problems are identified and taken into consideration.
- **Clinical evaluation:** Extensive preoperative clinical evaluation is used to identify and record all aspects of external, intranasal, and oral deformities and the degree of airway obstruction. The anatomic clinical evaluation is complimented as needed with nasopharyngoscopy, x-rays, imaging, and acoustic rhinomanometry.
- **Physiologic evaluation:** We depend on component rhinomanometry to fully evaluate nasal airway patency. This is an objective method that measures the resistance of each nasal cavity and the resistance of the velopharyngeal region. From these data, we are able to appreciate the area(s) that contribute to the airway obstruction and plan our procedure accordingly [26].

**Surgical techniques for correction of nasal deformities**

The final surgical plan is formulated based on the information gained from the extensive pre-operative evaluation. This plan is designed to manage and correct all components of the external and internal deformities and of the airway obstruction. A closed rhinoplasty approach can be used for small or moderate deformities. Open rhinoplasty approach is preferred for most cases with significant deformities. This approach allows for direct visualization and better appreciation of the deformities, thereby

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Fig. 7. (A) Significant residual cleft nasal deformity and airway obstruction. (B) Final result 7 years after nasal reconstruction, septoplasty, and partial bilateral inferior turbinectomies. (C and D) Pre- and postoperative pressure flow plots and corresponding numerical data obtained using component rhinomanometry. Significant improvement is noted.
### Nasal Airway Resistance

Nasal Cavity Total flow = 237.18 cc/sec

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Velopharynx

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NCR = 5.35

UPR = ****

NAR = 5.35

P: Pressure in cm H₂O

F: Flow in cc/sec

R: Resistance in cm H₂O/L/sec

A: Area in mm²

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### Nasal Airway Resistance

Nasal Cavity Total flow = 237.18 cc/sec

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Velopharynx

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Total Nasal Airway

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NCR = 1.60

UPR = ****

NAR = 1.60

P: Pressure in cm H₂O

F: Flow in cc/sec

R: Resistance in cm H₂O/L/sec

A: Area in mm²

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Fig. 7 (continued).
allowing a more accurate correction of all contributing components.

A detailed description of our surgical techniques has been published in the past [27]. Briefly, a V-shaped columellar incision is used to approach the nose. The alar cartilages and the domes are repositioned under direct vision to a symmetric position, and cartilage grafts are used to increase projection and symmetry or camouflage residual asymmetries. Deviations of the nasal bony pyramid are corrected with osteotomies, whereas profile deficiencies, depressions, and irregularities are corrected with cartilage and occasionally bone grafts. The columellar incision is closed in a V-Y fashion to provide additional length to the columella. Further nostril symmetry is achieved with incisions/excisions and repositioning. Finally, if the cleft-side nostril is found to be smaller than the normal nostril, an appropriate size composite graft from the ear is used to achieve symmetry.

Patients with bilateral clefts present with different requirements. With improved surgical techniques at the time of initial lip repair, the stage is set early on, and fewer patients require additional procedures to lengthen the columellar [28,29]. When additional length is needed, a fork flap for the lip can be incorporated into the design of open rhinoplasty. A composite graft from the ear can also be used. Septal or rib cartilage grafts are used for dorsal augmentation. A columellar strut graft is almost invariably used to improve tip support and projection. Various designs of tip grafts are used depending on the degree of the deformity (Figs. 7 and 8). The surgeon should always be sensitive to the racial and ethnic background of each patient and should avoid corrections that deviate from the racial norms.

**Correction of nasal obstruction**

The information gained from preoperative clinical and rhinomanometric evaluations assists us in formulating and individualizing a plan for simultaneous correction of airway obstruction. With component rhinomanometry, we can identify the level of obstruction. Attention is then directed toward the septum, the inferior turbinates, and, if necessary, to a potentially obstructing pharyngeal flap or pharyngoplasty.

Inferior turbinectomies, when needed, are performed first to enable us to better visualize the nasal cavities. Obstruction caused primarily by mucosal swelling can be relieved by excision of the redundant mucosa, but when inferior turbinate hypertrophy is caused by mucosal swelling and bony hypertrophy, an en bloc resection is performed.

When an open rhinoplasty approach is used, the septum is exposed after lateral reflection of the medial crurae of the alar cartilages. The mucoperichondrium on either side of the septum is dissected, and the septal cartilage is completely exposed along with the perpendicular plate of the ethmoid bone, the crest of the maxilla, the vomer, and the anterior nasal spine. Under direct visualization, all elements

Fig. 8. (A) Significant residual lip and nasal deformity after bilateral cleft lip repair. (B) Result after repair of nasal and lip deformities.
contributing to the nasal obstruction are managed (Figs. 7 and 8). If a dysfunction of the internal valve is present, it is corrected with spreader cartilage grafts harvested from the septum, whereas lining deficiencies are corrected with composite skin and cartilage grafts harvested from the ear.

Preoperative rhinomanometric studies along with direct evaluation provide invaluable information about the contribution of the velopharynx to the airway obstruction. If this obstruction is significant, a revision of the ports of the pharyngeal flap or the orifice of the pharyngoplasty should be considered. Such procedures should be performed with great care to avoid affecting the patient’s speech.

Summary

Every effort should be made to achieve the best possible results at the time of lip and palate repair. Appropriate and extensive evaluation, short- and long-term planning with optimal timing for each procedure, close cooperation with the members of the craniofacial team, selection of the most appropriate technique(s), careful execution, and close follow-up are prerequisites for success. Additional surgical procedures or revisions are required to improve appearance and function and to manage unfavorable results of previous interventions. Such procedures should be also planned carefully, taking into consideration all aspects of the deformity to provide our patients with superior habilitation.

References


