Management of Secondary Cleft Lip Nasal Deformity

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ABSTRACT

Background: Nasal deformity associated with cleft lip and palate is a highly challenging reconstructive problem. In this study both functional and aesthetic problems associated with cleft lip nasal skeletal deformity were evaluated and according to presenting deformity of each case, a management plan was proposed. Those who had remaining alveolar clefts were bone grafted then the skeletal foundation was established by maxillary osteotomies and finally rhinoplasty procedure was done.

Patients and Methods: The study was carried out in the Plastic Surgery Department, Assiut University and Plastic Surgery Department, Ain Shams University between May 2013 to April 2015 on 50 patients in outpatient clinic with secondary cleft lip nasal deformity.

Results: Eruption of canine was seen in 12 patients out of 15 whose underwent alveolar bone graft, occlusion and facial aesthetics were improved by maxillary advancement in all 10 patients in and nasal aesthetics was obtained in 17 patients out of 25 patients.

Conclusion: Down the line of the cleft lip nose management, deformity should be corrected early. Residual deformity must be addressed according to severity and underlying skeletal deformity. Bone grafting at the stage of mixed dentition in patients with residual alveolar cleft lip and palate were done. Maxillary advancement at the stage of permanent dentition was done in patients who had maxillary retrusion and lastly followed by rhinoplasty.

Key Words: Cleft lip nasal deformity – Alveolar bone graft – Le forte I osteotomy.

INTRODUCTION

Cleft lip and cleft palate are the most common congenital anomalies of the head and neck, having the incidence of 1:500 to 1:2500 births with male to female ratio 2:1 [1]. It is important to identify both aesthetic and functional problems associated with the cleft nose deformity. Nasal symmetry with improved nasolabial and nasofacial relationships and minimal evidence of surgical intervention fulfill the esthetic requirements. Functional objectives include a patent airway, proper position of the maxilla to provide Class I interdental occlusion and the achievement of normal speech [2]. Components of the nasal deformity include defects of the lower cartilage on the cleft side, the nasal septum, the columella, the nasal tip and the entire nasal pyramid. The maxillary cleft and hypoplasia and malpositioning of the maxillary segments also contribute significantly to the asymmetry. The anatomical and functional deformity of the orbicularis muscle also contributes to the nasal deformity, So, union of orbicularis muscle from the cleft and non-cleft sides in unilateral cleft cases and from both lateral elements across the premaxilla in bilateral cleft cases should be given adequate emphasis [3].

PATIENTS AND METHODS

This study was carried out in the Plastic Surgery Department, Assiut University and Plastic Surgery Department Ain Shams University between May 2013 to April 2015 on 50 patients in outpatient clinic with secondary cleft lip nasal deformity.

The patients were classified into three groups:

Group one: Which included 15 patients with mixed dentition and their age ranged from 9-11 years who underwent alveolar bone graft from iliac bone.

Group two: Which included 10 patients with permanent dentition with age above 18 years who underwent le forte one osteotomy.

Group three: Which include 25 patients with age above 18 years who underwent rhinoplasty.

Operative techniques: Group one (alveolar bone graft).

General anesthesia with a cuffed nasal endotracheal tube was used. The cleft area is widely exposed through incisions along the edges of the cleft.
The incision on the vestibular side is made along the gingival border. Anteriorly, the incision is extended along the gingival border to the center of the cleft-side central incisor. Vertical incisions are made along the edges of the cleft. On the palatal side, mucoperiosteal flaps are raised along the edges of the cleft. A wide exposure of the cleft area is achieved with these incisions. The nasal floor is reconstructed, through elevation of mucoperichondrial flap, thus creating two flaps for closure of nasal floor in case of oronasal fistula. On the palatal side, the mucoperiosteal flaps are sutured together with everting mattress sutures. This leaves a well-defined cavity, whose walls are periosteum and denuded bone. A cancellous bone graft is harvest from anterior iliac crest through a small incision. Chips of cancellous bone are removed by a sharp spoon, leaving the inner and outer cortex of the iliac bone intact. Haemostasis of the donor site was done with or without application of bone wax. Closure of donor site of bone graft. The alveolar cleft is completely filled with cancellous bone chips and then Closure of gingivomucosal junction [4].

Operative techniques: Group two (le forte I osteotomy).

General anesthesia with a cuffed nasal endotracheal tube was used. The tube is usually secured with a 2.0 silk suture to the membranous portion of the caudal septum. Before proceeding to the surgical incision. A solution of local anaesthetic with epinephrine (2% lidocaine with 1:100000 epinephrine) is infiltrated into the buccal mucosa along the entire surface of the maxilla in order to minimize bleeding and increase anaesthesia during surgical procedure. An incision was made through the mucoperiosteum approximately 7mm above the mucogingival junction; the mucoperiosteum was undermined backward to and around the maxillary tuberosity. The procedure was repeated on the contralateral side. The mucosa was then elevated from lateral wall and floor of the nasal cavity as well as lower aspect of the septum. A subperiosteal dissection made with a periosteal elevator exposes the lateral wall of the maxilla, from the pterygomaxillary junction to the anterior nasal spine. The dissection continues toward the maxillary tuberosity and pterygoid plate, with an inferior angled fold behind the zygomatic buttress. The piriform aperture is exposed, and the mucoperiosteum is elevated along the piriform rim, the nasal floor and the lateral wall under the inferior turbinate, then reflected with a peristomal elevator to expose the anterior floor of the nose. The osteotomy begins placing a bur or a surgical saw posteriorly at the zygomaticomaxillary buttress, and advances medially the maxilla to the piriform rim. Before performing the osteotomy of the lateral wall of the nose, a periosteal elevator is inserted subperiosteal under the inferior turbinate, at the piriform aperture to protect the nasal mucosa. A flexible retractor is placed under the peristomeum at the junction of the maxillary tuberosity with the pterygoid plates, to avoid the risk of damaging the maxillary artery or one of its branches. Then osteotomy of the septum and the lateral nasal wall are performed. A septal osteotome is carefully inserted along the septal crest of the maxilla under the intact nasal mucosa, in order to separate the cartilaginous and bony septum from the sepal crest of the maxilla. An elevator protect the nasal mucosa when the nasal lateral wall is sectioned by an osteotome directed posteriorly and inferiorly toward the perpendicular plate of the palatine bone. After removing gauze sponges previously placed, a retractor is inserted subperiosteally in order to place a curved osteotome at the junction of the maxilla and pterygoid plate. The osteomized maxillary segment can be downfracture. During this procedure nasal mucosa partially attached is carefully elevated from the nasal floor. After downfracture, mobilized maxilla freely move in all of the three planes. At this time an occlusal wafer splint is inserted and maxilla and mandible are fixed together by 25-Gauge wire for maxillomandibular fixation. The nasal floor and the posterior maxillary area are exposed and wash with saline solution to remove blood clots.

Maxilla was placed in the new position, then two bone plates for each side are set to the piriform rim and to zygomatic buttress. After rigid fixation, maxillomandibular stabilization devices are removed. Closure of gingivomucosal junction [5].

Operative techniques: Group three (Rhinoplasty).

Surgical procedures for correction of unilateral cleft lip-nose deformities: General anesthesia with a cuffed oral endotracheal tube positioned midline was used. The nose and anterior aspect of the maxilla on the cleft side infiltrated with 0.5% lidocaine and 1:400,000 epinephrine. Open rhinoplasty is applied according to the bilateral reverse-U incision and transcolumnellar incision. A reverse-U incision is made on the outer skin slightly above the nostril rim in order to lengthen the upper columnella on the affected side. The distal ends of the incision are extended into the nostril and connected to the back cut incision along the nasal vestibule. The lower end of the back cut incision is extended to the nasal floor and to the white lip along previous surgical scars, when simultaneous correction of upper lip deformity is necessary. Through the oral
and nasal vestibular incision, supraperiosteal dissection surrounding the piriform margin is performed on the affected side. This dissection provides 3D movement of the nasal alar base and enables the medial-upward advancement of the nasolabial components. Deviation of the columnellar base is corrected by supraperiosteal dissection around the anterior nasal spine through the oral vestibular incision. When the base of the nasal septum is severely deviated, the inferior edge of the septal cartilage is excised to allow repositioning to the midline, and then it is secured to the small hole made at the piriform bottom. Reflecting the nose tip skin, the malpositioned lower lateral alar cartilage is exposed from both the nasal skin and lining mucosa, and the distal ends of the lateral crura are freed from the surrounding tissue. Since the corrected cartilage is often insufficiently supported, a small, square cartilaginous strut approximately is taken from the lower part of the nasal septum, and transferred to the anterior edge of the nasal septum; a caudal septal extension graft. When the growth of the nasal septum is too underdeveloped, free auricular cartilage is used for a caudal septal extension graft. The medial crus of the lower lateral cartilage on the affected side is repositioned in a slightly overlapped position on the upper lateral cartilage and fixed symmetrically to the caudal septal extension graft. After the nasal tip skin is redraped, the nasal lining is advanced medially and upwardly to cover the nostril dome. The excess skin at the nostril rim on the cleft side is also reflected and push backed into the canopy of the nostril rim. The defect of lining mucosa, and the distal ends of the lateral crura are freed from the surrounding tissue. When simultaneous correction of upper lip deformity is carried out, the orbicularis oris muscle is separated along the previous scar. After dissecting these muscles from the maxillary wall, the medial and distal bundles of orbicularis oris muscle are connected in an overlapping manner using a mattress suture technique. At the end of surgery, subcutaneous and cutaneous suturing is carefully performed [6].

Surgical procedures for correction of bilateral cleft lip-nose deformities:

General anesthesia with auffed oral endotracheal tube positioned midline was used. The nose and anterior aspect of the maxilla on the both sides in bilateral lip nose deformity are infiltrated with 0.5% lidocaine and 1:400,000 epinephrine. Open rhinoplasty is applied according to the bilateral reverse U incision and transcolumnellar incision, or bilateral columelloprolabial but rim incisions on the bilateral side are made on the outer skin slightly above the nostril rim in order to lengthen the upper columella. The distal ends of the incision are extended into the nostril and connected to the back cut incision along the posterior edge of the nasal vestibule. Through oral and nasal vestibular incision, supraperiosteal dissection surrounding the piriform margin and lower border of the upper lateral cartilage is performed. These dissections allow repositioning of the nasalis muscle at an adequate position on the anterior maxillary wall and facilitate 3D medial-upward-frontal advancement of the nasal alar base. Reflecting the nose tip skin, the malpositioned lower lateral cartilages are exposed from both the nasal skin and lining mucosa, and the distal ends of the lateral crura are freed from the upper lateral cartilages. Cartilaginous strut is then transferred to the anterior edge of the nasal septum to produce nasal tip projection. Medial crura of the bilateral lower lateral cartilages are repositioned in a slightly overlapped position on the upper lateral cartilage and fixed to the caudal septal extension graft symmetrically. When the growth of the nasal septum is too underdeveloped to use a cartilaginous graft, free auricular cartilage is transferred to the nasal tip. To resolve the tightness of the skin envelope that often causes the collapse of the caudal septal extension graft, subcutaneous fibrous tissue is widely dissected around the nasal tip, and then elongated by the V-Y method at the columnellar base. To produce the nasal tip projection, the lateral parts of the subcutaneous fibrous tissue are dissected vertically and molded on the nasal tip. When the nasal tip skin is redraped and skin is insufficient to cover the base of columella due to the improved nasal projection, inferiorly based small pedicle flaps are made from the rim skin below the incision and rotated medially into the raw area of the columellar base. After repositioning the lower lateral cartilage, the nasal lining tissue is advanced medially and upwardly to cover the nostril dome. The defects of lining at the nasal vestibule caused by the upward advancement of the alar component are then covered by a free mucosal graft donated from the buccal area. At the end of the operation, subcutaneous and cutaneous suturing is carefully performed [6].

RESULTS

This study was carried out in the Plastic Surgery Department, Assiut University and Plastic Surgery Department, Ain shams University between May 2013 to April 2015 on 50 patients with secondary cleft lip nasal deformity.
The patients were classified into three groups:

**Group one:** Which included 15 patients with mixed dentition and their age ranged from 9-11 years who underwent alveolar bone graft from iliac bone.

**Group two:** Which included 10 patients with permanent dentition with age above 18 years who underwent le forte one osteotomy.

**Group three:** Which include 25 patients with age above 18 years who underwent rhinoplasty.

**Group I: Alveolar bone graft:**

This group included 15 patients. The age of the patients in this group ranged from 9 to 12 years old. The mean age of the patients was 10.5 years. There were 9 male patients and 6 female patients. Of the 15 treated patients, eruption of canine was seen in 80% of cases (12 patients) while only 20% of cases (3 patients) did not develop eruption of canine. Bone was found at original site of defect.

Donor site morbidity in the form of persistent pain and sensory disturbance for 6 weeks post operative was seen in 13.3% of cases (2 patients).

**Group II: Maxillary advancement:**

This group included 10 patients. The age of the patients in this group ranged from 18 to 26 years old. The mean age of these patients was 21.1 years. There were 7 male patients and 3 female patients.

The cleft was unilateral in 8 and bilateral in 2 patients. Five patients had previous alveolar bone graft, occlusion and facial aesthetics were improved by maxillary advancement in all patients during the follow-up period with no signs of relapse. Fixation was done by miniplates. premaxilla was intact in 9 patients and missed in one patient.

**Group III: Rhinoplasty:**

This group included 25 patients. The age of the patients ranged from 18 to 26 years old. The mean age of these patients was 21.5.

There were 14 males and 11 females. 68% of patients (17 patients) were suffering from unilateral deformity and 32% of patients (8 patients) had bilateral deformity. Of the 25 treated patients, 60% of cases underwent cartilage graft (15 patients), 10 in unilateral cases and 5 in bilateral cases. Suture Suspension was done in 76% of cases (19 patients), 12 in unilateral and 7 in bilateral cases. Only 12% of cases (3 patients) needed le forte one osteotomy prior to corrective rhinoplasty.

Nasal symmetry was obtained in 68% of cases (17 patients). There were no perioperative complication such as bleeding, infections, or wound disruption.

Fig. (1): Female patient 21 years underwent alveolar bone graft.

(A) Alveolar cleft prior to bone graft (the alar base is displaced posterior and inferior).

(B) Pre-operative intraoral view.

(C) Post-operative bone graft (alar base is elevated by bone graft).

(D) Bone formation at the cleft defect.
Fig. (2): Female patient 23 years with maxillary retrusion underwent le forte I maxillary advancement.

(A) Pre & Post-operative antero-posterior view

(B) Pre & Post-operative Lateral View.

(C) Pre & Post-operative occlusion view.
Fig (3): Female patient 23 years with repaired bilateral cleft lip and palate case and had maxillary retrusion underwent le forte I maxillary advancement and bilateral sagittal split osteotomy.

(A) Pre & Post-operative anteroposterior view.

(B) Pre & Post-operative lateral view.

(C) The maxillary retrusion & mandibular protrusion are further confirmed by the lat cephalometric tracing.

(D) Post-operative panoramic X-ray showing double jaw surgery in the form of le fort I advancement and SSO setback.
Fig. (4): Male patient 25 years with bilateral cleft lip nasal deformity underwent corrective rhinoplasty (lengthened columella, elevated nasal tip and set tip projection, adjusted dorsal height and symmetry given for the nostrils).

(A) Pre & Post-operative antro-posterior view.

(B) Pre & Post-operative Lateral View.

(C) Pre & Post-operative Basal View.
Fig. (5): Male patient 25 years with bilateral cleft lip nasal deformity underwent corrective rhinoplasty (lengthened columella, elevated nasal tip and set tip projection, adjusted dorsal height and symmetry given for the nostrils).

**DISCUSSION**

Cleft lip nasal deformity present a major challenge in the management of cleft lip patients as the deformity presents a stigmata of cleft lip even with a properly and nicely repaired cleft lip [7].

During the cleft lip repair the main concern of plastic surgery is to correct properly the cleft lip deformity and in many cases an acceptable nasal shape is acquired with this repair. However, with the growth of the patients, nasal deformities become more apparent [7].

It must be the principal aim of cleft surgeon to restore deformed and displaced regional anatomy to as close to normality as possible, whether or not true hypoplasia exists. Only in this way restoration
of function might be reasonably expected, thus enabling optimal growth and development. Primary surgical methods encompassing these ideals should, theoretically reduce frequently observed sequelae of both cleft deformity and surgery and so, in turn, the need of secondary surgery. In reality, even in the most favorable circumstances, secondary surgery will be required [8].

The pathogenesis of secondary deformities is related to specific features as: The presence of scar tissues into cleft basal bone area that inhibits alveolar growth; scarring of palatal soft tissue that inhibits growth and causes palatal orientation of dentoalveolar elements; the exceeding lip tension that may inhibit maxillary growth along dentoalveolar structures. Clinically, it is possible to observe obvious signs of failure of midfacial growth, in terms of a horizontal disproportion of dentoalveolar arches and malocclusion not limited to cleft area, collapse or deviation of nasal structures and evidence of muscle dysfunction including an inability to protrude the upper lip, whether symmetrically or asymmetrically; Clearly; the earlier secondary revisional procedures are carried out; the less will be the adverse effect on growth, development, and psychological concerns [9]. Simultaneous surgery of cleft lip nasal deformity should be performed with the aim of reducing surgical stress of the patient, improving aesthetic and functional outcomes in one surgical step and reducing risk of psychological consequences. Furthermore, simultaneous surgery should be performed at the end of facial growth which is 17 years in females and 18 years in males [10].

In this study we classified patients according to their ages, in the first group, secondary bone graft for alveolar cleft and depressed nasal floor in mixed dentition age in which patients ages ranged from 9 to 12 years. It was similar to that reported in the studies before [11,12,13].

The optimum time is when the root of the permanent canine has formed by approximately one fourth to two thirds of its length, grafting before eruption of the permanent canine teeth generally results in more stability with better bone support.

In this study, of the 15 treated patients, eruption of canine was seen in 80% of cases (12 patients) while only 20% of cases (3 patients) did not develop eruption of canine, this is coincides with Abhilasha, 2013 [4] who stats eruption of canine was seen in 75% of cases. This finding was also in accordance with the observation made by Bjork & Skiller, [14] and Hinrichs, [15].

Pain and parathesia in the donor site from iliac crest occur in two patients immediately post-operative and lasts for 6 weeks only. There was no sign of morbidity at donor site in 100% cases. This finding correlates the findings of Cohen and Figueroa, [16]. They stated that the procedure was significantly shorter when an iliac crest bone graft was used since the bone graft was harvested simultaneously with exposure of the alveolar cleft by an average of one hour.

In this study, we performed Le fort I advancement in adolescent patients in permanent dentition stage. In 1977, Freihofer [17] stated that maxillary advancement should be delayed until permanent dentition. He documented high incidence of “pseudorelapse” secondary to mandibular growth in adolescent patients. This was later confirmed [18].

In this study the indication Le forte I differed significantly between sexes (30% [3/10] of female patients and 70% [7/10] of male patients). This finding is not consistent with reports from a previous study that found no difference between sexes [19].

In this study bone fixation was done using miniplates and no grafts were employed. This finding is not consistent with reports from a previous study by Araujo et al., [20] in their series of maxillary advancement stabilized the fragments using Stienmann pins and performed bone grafting. They found significant decrease in relapse, particularly when grafting was done between maxillary tuberosity and pterygoid plates.

The patients with CLP have typically undergone numerous craniofacial surgeries for correction of the palatal and/or lip cleft before Le Fort I maxillary advancement. Soft tissue scarring might not only be the potential cause of the midface deficiency, but also the cause of surgical relapse, restricting the surgical movement of the maxilla and pulling it back to the pre advanced position [21].

In addition, posterior pharyngeal flaps from a previous surgery and disharmony of occlusion are expected to be additional reasons for relapse after Le Fort I osteotomy in patients with CLP. In this study, relapse cannot assessed well due to short follow-up period.

In this study, the age of the patients ranged from 18 to 26 years old to whom we had done rhinoplasty, many author sated that the nasal growth is complete at approximately 11 to 12 years of age in girls and 13 to 14 years of age in boys. 68% of
patients were suffering from unilateral deformity and 32% had bilateral deformity, this is coincided with Ahmed and Ramadan, [22] showing in a study of 22 patients 72% of patients were suffering of unilateral deformity and 28% had bilateral deformity.

In this study, of the 25 treated patients, 60% of cases underwent cartilage graft (15 patients). Only 12% of cases (3 patients) needed le forte one osteotomy with rhinoplasty.

We use cartilage grafts harvest from septum to augment and stabilize the malformed lower cartilage to improve tip definition and symmetry and this agrees with Stal and Hollier, [23].

Hemostasis was obtained with local infiltration with adrenaline but Lo et al., [24] did not use infiltration by adrenaline and Hemostasis was obtained by compression and coagulation; this is to avoid tissue swelling and distortion that may create difficulty for precise incision and approximation of the corresponding landmarks.

In this study, the open rhinoplasty approach was used has many advantages when combined with the repair of the cleft lip. It permits mobilization and repositioning of unscarred key elements of the nasal tip under direct vision and also it reshapes the related contours of the upper lip and nostril. Wide exposure of the entire alar cartilage framework attached with the nasal mucosa achieved by the open tip rhinoplasty technique allows movement of the alar cartilage and mucosa as a composite entity. Closed rhinoplasty technique does not allow intercural soft tissues dissection and this is consistent with the study of Thomas et al., [3].

There were no post-operative complications and most of patients were satisfied with functional and aesthetic results of secondary cleft lip nasal deformity.

Conclusion:

Cleft nasal deformity is a complicated problem that should be addressed during multiple stages of the patient’s life. Down the line of the cleft lip nose management, deformity should be corrected early. Residual deformity must be addressed according to severity and underlying skeletal deformity. Bone grafting at the stage of mixed dentition in patients with unilateral or bilateral defect of residual alveolar cleft lip and palate patients were done. Function was restored by stabilizing the maxillary segments to form a continuous arch and occlusal relationship of the maxilla and mandible was achieved in long-term follow-up.

Maxillary advancement at the stage of permanent dentition was done in patients who had maxillary retrusion and lastly followed by rhinoplasty which best approached after nasal growth has concluded and done via an open technique to fully visualize the nasal structure.

REFERENCES