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Case Report

Presurgical nasopalveolar moulding: A boon in the management of cleft lip and palate

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Introduction

A particularly difficult challenge in the cleft lip and palate (CLP) cases is establishment of a columella/non-surgical lengthening of columella which is present in a rudimentary form in such cases and the nasal cartilages deformity correction. The temporary plasticity of nasal cartilage and alveolar ridge in the neonatal period is attributed to maternal oestrogen triggered high levels of hyaluronic acid, found circulating in the infant for several weeks after birth.¹ This temporary plasticity is made use of in

presurgical nasopalveolar moulding (PNAM), to provide measurable long-term benefits to the patient.^{2,3} The various advantages of PNAM include active moulding/repositioning of the deformed nasal cartilages/alveolar processes, lengthening of the columella, anatomical lip position facilitating repair with minimum scarring, more favourable bone healing, reduced need for secondary alveolar bone grafts, hospitalization time/cost and provide the psychosocial benefit to the family. The few drawbacks associated with the procedure are airway obstruction from ill-fitting appliance, locked out segment, alar rim expansion, soft tissue irritation and fungal infection.

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Fig. 1 – Unilateral CLP pretreatment extraoral/intraoral view.

The PNAM is achieved by an oral appliance, which needs continuous modification as the treatment progresses. An accurate impression, while maintaining airway patency, is the key to fabrication of good appliance and to that effect various techniques used are infant upside-down, supine position, infant in mother's lap with head down, etc. depending on operators expertise. The elastomeric impression materials are the best choice for impression recording to meet the desired goals although impression compound and alginate can also be used. Two cases, one each of unilateral and bilateral CLP treated with the PNAM, are presented.

Case 1

A 7-day-old infant with CLP was referred for evaluation and fabrication of feeding appliance. On examination, there was complete unilateral CLP of the right side with oro-nasal communication. The size of the cleft measured 12.5 mm at the alveolus and nose tip was deviated 7 mm from the midline (Fig. 1).

Keeping in sight the size of defect, the case was taken up for PNAM to achieve more aesthetic surgical closure. The preliminary impression was made with impression compound followed by final impression in elastomeric material for fabrication of appliance. Initially, a feeding plate was inserted

to achieve comfortable adaptation followed by PNAM appliance. The alveolar segments were gently moulded with the appliance and manual manoeuvre every 3-4 days.

When the defect was reduced to 6 mm, after 5 weeks, a nasal stent made of aluminium wire was added to the appliance. The nasal end of the wire was covered with the soft acrylic to form nasal button. The adjustment of appliance continued and nasal stent was adjusted to obtain normal shape of the right nostril. The result after 2.5 months was as shown in Fig. 2, with alveolar defect reduced by 9.5 mm, definite columella established, nostril shape normalized and nose tip aligned almost in the midline.

Case 2

A 4-day-old infant with CLP referred for assessment to help improve feeding. On examination, there was incomplete bilateral cleft lip, complete bilateral cleft palate with premaxillary prominence and oro-nasal communication (Fig. 3). The alveolar clefts were not wide but columella was deficient and direct surgical intervention would have depressed the tip of nose producing permanent deformation.

With the sight on elongation of columella to achieve normal nose shape and post-surgical growth, the treatment was planned for dual purpose of feeding appliance and

Fig. 2 – Post-PNAM extraoral/intraoral view of unilateral case.

Fig. 3 – Bilateral CLP pretreatment extraoral/intraoral view.

columella lengthening before surgical repair. The elastomeric impression of the maxillary arch was made, feeding plate fabricated and inserted initially followed by a PNAM appliance.

After 2 weeks, the nasal stents were incorporated, try-in of the appliance for comfortable fit done and then secured with the surgical tapes. The adjustment of appliance continued every 3–4 days to achieve intended benefits. Three months of PNAM therapy produced excellent result in the form of definite lengthening and delineation of the columella from the premaxillary segment and constriction of the wide alar bases to give normal nose shape (Fig. 4).

Some procedural steps involved in the PNAM therapy are illustrated in Fig. 5.

Discussion

Millard described that unilateral and bilateral cleft arise as a result of failure of the mesenchyme to migrate from the

maxillary processes into the medial nasal process.⁴ As a result, the maxilla and premaxilla do not form a bony union either unilaterally or bilaterally depending on side/sides of migration failure. This presents a discrepancy and displacement of components of the nasomaxillary complex that persists without appreciable improvement during growth.

In the case of unilateral cleft, there is projection and outward rotation of the premaxilla along with retro positioning of the anterior maxillary wall on the affected side.⁵ This causes flattening of the nasal tip and inferior displacement of the soft triangle. The nasal septum is twisted, slanted and dislocated out of vomerine groove, resulting in twist to the nasal tip.⁶ The most obvious aspect of a complete bilateral cleft is the protruding premaxilla. Due to lack of connection of the premaxilla with the lateral palatal shelves, the premaxilla protrudes on a vomerine stem. The anterior nasal spine is poorly formed or absent, resulting in a retruded area under the base of the septal cartilage and recession of the medial cartilage. The lower lateral cartilages are displaced posteriorly

Fig. 4 – Post-PNAM view illustrating increased columella length.

Fig. 5 – Some procedural steps involved in the PNAM therapy.

and laterally, which in turn pulls the normal junction (genu) of the medial and lateral cartilages apart resulting in a broad, flat nasal tip. This along with lateralization of the domes, and deficient skin, produces the typical “absent columella.”

Two treatment philosophies have evolved for the management of CLP cases: surgical correction alone versus PNAM-assisted surgical correction. The advantage of one over the other is riddled by controversies and conclusive opinion is lacking. Ross et al.⁷ described one benefit of PNAM, that maxillary segments can be repositioned so that lip segments are in closer apposition enabling a more precise repair with less tension. As the logic would define it, the larger the defect, greater the mobilization of soft tissues required, more the stretch, greater the scar and thus predisposition to retarded maxillary growth. A uniform osseous base achieved with the controlled contouring of alveolar ridges produces a better definitive lip repair with fewer revisions.⁸ In patients with unilateral cleft lip-cleft palate (UCLP), Barillas et al. showed that nasal cartilages were more symmetric in infants treated with PNAM than in those treated with surgery alone and this improvement was evident at 9 years of age.⁹ A major benefit of PNAM in bilateral cleft lip-cleft palate (BCLP) is the ability to presurgically lengthen both the columella skin and the prolabium, creating enough skin to reconstruct the central lip length without compromising nasal tip projection. Garfinkle et al. reported near-normal anthropometric nasal measurements for patients with BCLP treated with PNAM compared with a non-cleft sample up to age 12 years and the measures of nasal growth proceeded in parallel with the non-cleft population.¹⁰

Advocates of PNAM have stated that, besides other advantages of traditional appliances, the main objectives of

PNAM are improving nasal symmetry/nasal cartilage deformity, columella lengthening and lip aesthetics while opponents state that all these approaches are complex, expensive and might have an adverse effect on maxillary growth. But none of these claims are evidence-based.¹¹ As there is not yet a definitive conclusion on the subject, its application cannot be over-looked. Moreover, although the views on the long-term effect of PNAM on alveolar cleft defect, maxillary arch dimensions and subsequent facial growth may be divided, its advantage in achieving nasal symmetry and columella correction/lengthening is unanimous.¹²

The biggest limitation of PNAM is with infant management during treatment and the training of the parents to manage the appliance. This may be one of the reasons to achieve inadequate results and antagonistic view to PNAM therapy. But keeping in view the larger interest of the patient, the technique can be mastered over a period of time.

Following PNAM, primary surgery can be undertaken in the form of cheilo-rhinoplasty or can be combined with gingivo-periosteoplasty (GPP). GPP has an additional benefit to reduce the need for secondary alveolar bone grafting by about 60%.^{3,13} But the disadvantage of GPP is detrimental effect on the growth if the periosteum is stretched over a distance. So, the surgical procedure should be chosen with caution depending on the expertise of the operating surgeon.

Conclusion

PNAM is a highly advantageous adjunctive procedure for the management of congenital unilateral/bilateral CLP cases for non-surgical columella elongation, correction of nasal

cartilage deformity and moulding of the alveolar processes. If applied judiciously, surgical challenge can be considerably reduced. More aesthetic closure of the defect can be achieved minimizing lip revision surgeries, secondary alveolar grafting and extensive rhinoplasty. Moreover, it gives psychological assurance to the parents as they visibly see the reduction of defect over a period of time.

Conflicts of interest

The authors have none to declare.

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