Nasoalveolar Moulding for Children with Unilateral Cleft Lip and Palate

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Abstract

Introduction Cleft lip and palate represents the most frequently occurring congenital deformity second only to club foot deformity in our country. Wide alveolar clefts if not preceded by pre surgical orthodontic adjuncts like nasopalveolar moulding, may affect the final outcome of the primary surgery. Presurgical nasopalveolar moulding is to align and approximate the alveolar cleft segments while at the same time achieving correction of the nasal cartilage and soft tissue deformity.

Materials and methods The device we used is designed by Barry Grayson. It is simple to fabricate, causes less discomfort to the patient and optimum results are achieved in three months of time, compared to other complicated appliances like Latham's which are more invasive. A child of 3 months presented with a complaint of unilateral cleft deformity on one side of the face.

Conclusion After three months of nasopalveolar moulding considerable changes were observed. The widths of the cleft alveolus were reduced and the nasal contours of columella on the cleft side showed considerable improvement.

Keywords Unilateral cleft lip and palate · Nasal stent · Nasopalveolar moulding · Nonsurgical columella elongation · Presurgical orthopaedics

Introduction

Cleft lip and cleft palate are the most common congenital malformations. The reported incidence of cleft of lip and palate varies from 1 in 500 to 1 in 2,500 live birth depending on the geographic origin, racial and ethnic backgrounds and socioeconomic status. The unilateral cleft lip and alveolar deformity is associated with significant abnormality in nasal cartilage morphology and asymmetry of alar base and columella. The lower lateral alar cartilage is often depressed and concave. The goal of presurgical nasopalveolar moulding is to align and approximate the alveolar cleft segments while at the same time achieve correction of the nasal cartilage and lip deformity. These corrections are achieved by adding a nasal stent to the labial vestibular flange of a conventional intraoral moulding plate. The nasal stent and alveolar moulding plate are adjusted gradually over a period of 3 months to achieve nasal and alveolar symmetry, nasal tip projection, and contact of the cleft alveolus just before primary lip, nasal, and alveolar surgical repair. The nasopalveolar orthopaedic appliance is held in place with a combination of surgical tapes and elastics applied to the cheeks and cleft lip segments. The pre-surgical reduction in osseous and soft tissue cleft deformity considerably reduces the magnitude of the surgical challenge, resulting in improved surgical outcomes.

The advantages of nasopalveolar presurgical infant orthopaedics may be considered from a soft tissue perspective as well as from the usual osseous perspective. The pre-surgical reduction in soft tissue and cartilaginous deformity facilitates achievement of surgical soft tissue repair under minimal tension and optimal conditions for scar formation. There is also a reduction in the number and complexity of minor soft tissue revision surgeries required to maintain acceptable nasolabial aesthetics as the nose grows.

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Case Report

A male child of 3 months and 27 days of age presented with a complaint of cleft deformity on one side of the face (Fig. 1). Examination revealed that it is a unilateral

Fig. 1 Pre treatment (extra oral)

Fig. 2 Pre treatment

complete cleft on the left side involving lip, alveolus, hard palate and soft palate. Intraorally the alveolar segment showed a discrepancy in the sagittal relationship between cleft side and noncleft side (Fig. 2).

To reduce the width of the alveolar cleft, and to improve the alignment of the base of the nose and lip segment which enables the surgeon to enjoy the benefit associated with repair of an infant that has minimal cleft deformity, pre-surgical nasoalveolar moulding (NAM) was decided in this case. Vertical and horizontal measurement of the cleft of the lip and nose was measured to evaluate the treatment changes.

Appliance Construction

A heavy bodied impression material was used to take the impression of the child's mouth. A cast or model of the alveolar anatomy was made with dental stone. Moulding plate was fabricated with hard clear acrylic and lined with a thin coat of soft denture material. A 5 mm diameter hole was made in the centre of the acrylic palatal vault to provide an airway in the event that posterior border of the plate drops down onto the tongue (Fig. 3).

Fig. 3 a Impression b Plaster Model

Parents were instructed to keep the appliance full time and to be removed for cleaning as needed, at least once a day. The appliance was secured extra orally to the cheeks, bilaterally by surgical tapes which have an orthodontic band at one end. The elastics loop over a retention arm extending from the anterior flange of the plate. The retention arm was positioned approximately 40° down from the horizontal plane to achieve proper activation and to prevent unseating of the appliance from the plate (Fig. 4). The tapes and elastics were changed once a day.

Weekly visits were required to modify the moulding plate to guide the alveolar segment into the desired position.

Fig. 4 NAM Appliance

Parents were instructed to place the tapes. In order to approximate the cleft lip segment the tape should be applied at the base of the nose and it should be applied to the non-cleft side first, then pulled over and adhered to the cleft side.

After 3rd week a nasal stent, made of 0.036" round stainless steel with a "swan neck" shape at the end, was added to the appliance (Fig. 5). A layer of soft acrylic was added to the hard acrylic for comfort. The upper lobe of the nasal stent enters the nose and lifts the dome until a moderate amount of tissue blanching occurred.

After 3 months of naso-alveolar moulding considerable changes occurred (Fig. 6)

- Width of the cleft in the lip is reduced by 2.3 mm (Fig. 7)
- Width of the cleft in the alveolus is reduced by 5.5 mm (Fig. 8)
- Alveolar segment on the non cleft side moved inward and on the cleft side moved outward (Fig. 9)
- Nasal contour of the columella on the cleft side increased (Fig. 10).

After 3 months of NAM, lip surgery was performed (Fig. 11).

Fig. 5 Nasal stent

Fig. 6 a Pre treatment b After 3 months NAM

Fig. 7 Lip changes measurements **a** Pre treatment **b** 3 months of NAM

Fig. 8 **a** Pre treatment **b** 3 months of NAM

Fig. 9 **a** Pre treatment **b** 3 months of NAM

Fig. 10 Nasal changes **a** Pre treatment **b** 3 months of NAM

Discussion

In 1686 Hoffman described the use of head cap with arms to retract the premaxilla and narrow the cleft. Georgiade and Latham (1975) introduced a pin retained appliance to retract the pre maxilla and expand the posterior segments [1]. Grayson et al. [2] described presurgical nasoalveolar

moulding to correct the alveolus, lip and nose in infants born with cleft lip and palate.

The NAM treatment protocol for cleft patients has been described by Grayson et al. [2], Brecht et al. [3], Grayson and Santiago [4] and Cutting et al. [5]. The results of nasoalveolar moulding in the patient presented are consistent with similarly treated cases described in literature.

Fig. 11 After 3 months of naso alveolar moulding, post lip surgery

The treatment objective is to align the alveolar segment, restore the lower lateral cartilage position, and increase the columella length [6]. Palatal plate therapy yielded a reduction of cleft width by 5.5 mm in the alveolar cleft area after a treatment period of 3 months. This effect is most likely to result from a combination of factors. The palatal plate prevent tongue insertion into the cleft which will otherwise lead to the cleft margins being pushed apart [7]. The selective modification on the inside of the plate done every week leads to the alveolar segment on the non cleft side to move inward and on the cleft side to move outward. Additional effects on the alveolar cleft were accomplished using adhesive plaster tractions applied across the cleft lip [8].

Alar elevation accomplished in the present case, approximately of 2 mm, was similar to that described by other authors. Liou et al. [9] achieved an average 2.7 mm alar elevation in their patients during 1–3 months, and Singh et al. [10] arrived at 2.2 mm lifting after 3.5 months.

Grayson et al. [2] indicated that nasal moulding alone is not sufficient to correct deformity of the nasal tip. Although NAM stretches the columella skin into a more normal configuration and normalizes the shape and position of the lower lateral cartilages, coordinated primary nasal surgical correction is still required after NAM.

Several factors affecting insufficient recovery of the nostril forms can be listed as follows: (1) insufficient nasal moulding before surgery, (2) insufficient nasal undermining, (3) insufficient overcorrection of the lower lateral cartilage, and (4) post-operative contracture of the

subsequent tissue in the vestibule [6]. Therefore, pre-surgical orthopaedics providing more symmetric bone support as well as a symmetric shape of the nasal cartilages will be required for the management of nose deformity in complete UCLP.

Conclusion

Pre-surgical nasoalveolar moulding helps the surgeon and patients with cleft to attain better aesthetic and functional outcome. This also reduces the number of surgical revisions for excessive scar tissue, oro-nasal fistulas, nasal and labial deformities.

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