CASE REPORT- MANAGEMENT OF UNILATERAL CLCP PATIENT BY NASOALVEOLAR MOLDING

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PRESENTATION OF CASE

Clefts of the lip and palate unfortunately are by far the most common major facial malformations in mankind. Fortunately, as a result of technical advancements in the fields of medicine and their families for treatment, much can be done and achieved for them.

The orthodontist by virtue of having gained in depth knowledge of the craniofacial complex, its growth and development and expertise in tooth movement has to play a role of prime importance in making critical decisions, planning treatment and rendering care to these patients.

Nasoalveolar Molding (NAM) is a tissue-expansion procedure performed by dentists prior to a surgical repair for cleft lip and palate.[1] The NAM technique allows the paediatric dentist and surgeon to mold the abnormally-formed nasal cartilage into a more optimal relationship prior to surgery.[2] The carefully-controlled tissue expansion created by the NAM allows for the creation of a more normal-appearing nose at the time of surgery for the lip closure than compared to traditional treatment by secondary alveolar bone grafting.

Creating a symmetrical nose from the deficient columella and deformed nasal cartilage in cleft patients is a great challenge. The lower lateral alar cartilage in patients with unilateral cleft lip and palate is depressed and concave in the alar rim. It separates from the non-cleft-side lateral alar cartilage resulting in depression and displacement of the nasal tip. The columella is shorter on the cleft side and is inclined over the cleft with the base deviated toward the non-cleft side.

Presurgical nasal molding also has been introduced as an adjunctive neonatal management for preoperative correction of nasal deformities by utilising the malleability of alar cartilage shortly after birth. Grayson et al proposed the combination of presurgical orthopaedics and nasal molding as a new technique called presurgical nasoalveolar molding for approximating the alveolar cleft and improving the nasal deformities preoperatively.

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DIFFERENTIAL DIAGNOSIS

Cleft lip and palate often leave the middle part of the nose and the nasal cartilage deformed. Surgery alone is often not enough to provide an aesthetically acceptable correction. The NAM technique takes advantage of the malleability of immature cartilage of the nose and the ability to non-surgically construct the columella (middle part of the nose) through the application of tissue expansion. By the addition of a nasal portion to the molding plate, we can often correct the nasal tip, the base on the affected side, as well as the position of the philtrum and columella.[3]

It has been well researched that there is a temporary plasticity of the nasal cartilage and alveolar process in the early weeks of the neonatal period. It is believed to be caused by high levels of hyaluronic acid, a component of the proteoglycan intercellular matrix found circulating in the infant for the first few months after birth. The ideal time to begin NAM is 1-2 weeks after birth. The combination of nasal and alveolar presurgical infant orthopaedic molding (nasoalveolar molding) has resulted in measurable long-term benefits to the patient (Cutting et al, 1998; Santiago et al, 1998; Maull et al, 1999) and in medical economics (Pfeifer et al, 1998).[3,4,5,6,7]

CLINICAL DIAGNOSIS

A 2-months-14-days-old male infant reported with unilateral cleft lip and palate on the left side of face (Figure 1). After consultation with the cleft palate team, it was decided that the patient will be treated non-surgically at the beginning with NAM appliance so as to align the nasal cartilages, columella, philtrum and alveolar segments to facilitate the surgical restoration of a child's facial features to normal configurations.

Figure 1. Pretreatment Pictures of the Patient

PATHOLOGICAL DISCUSSION

Impression procedures in cleft infants pose a unique set of challenges in infants including the size constraints imposed by the infant's oral cavity, anatomical variations associated with the severity of clefts and a lack of ability of the infant to cooperate and respond to commands. All infant impressions are taken in the neonatal intensive care unit

with a surgeon present at all times to avoid complications and to handle airway emergencies. Primary impression for the present case was taken using impression compound (Figure 2).

Clinician must keep in mind that the quality of a cleft lip and palate impression depends on two factors- complete inclusion of the lateral maxillary segments with a good reproduction of the mucobuccal fold and adequate extension of the impression into the cleft area. The impression must extend into the nasal chamber and every available undercut. It is these undercuts that provide retention capability of the appliance. Parents are instructed not to feed the infant for at least two hours prior to the procedure. High volume suction is also ready at all times in case regurgitation of the stomach contents occurs during the procedure. The impression is made when the infant was fully awake without any anaesthesia or premedication. Infants should be able to cry during the impression procedure and absence of crying maybe indicative of airway blockage. The parent sat on a stool of adjustable height. The infant was made to lie in a supine position on the lap of the parent with the head on the knee at a lower level. The clinician positions himself in a comfortable 10 o'clock position to the infant's head. A wax sheet of approximate size and shape is adapted intraorally using the thumb and index finger. Impression compound is also used for impressions of infants with oral clefts. The advantages of its use are that it can be removed before it sets in case of any emergency and it has excellent resistance to tearing. Impression compound, however, is a thermoplastic material and overheating can lead to scalding or burns in infants and leaching out of volatile components of the compound, which may be harmful to the infants. A wax spacer is adapted on the stone model on which a custom acrylic tray with a handle is prepared (Figure 2).

Figure 2. Primary Impression, the Cast and the Acrylic Moulding Plate

A ***B***

Figure 3. A) Nasoalveolar Moulding Plate in Mouth, B) Feeding with the Moulding Plate

Figure 4. Secondary Impression and Cast

Figure 5. Nasal Stent Added to the Moulding Plate

Figure 6. After 4 Months of Treatment with NAM Appliance

Figure 7. Comparision of Pre-NAM Treatment and Post-NAM Treatment Casts After 4 Months

The tray is smoothened and polished to avoid rough areas. Pea-sized amounts of fast setting elastomeric putty material are kneaded together taking care to use more catalyst to accelerate setting, loaded into the custom tray and impressions obtained with the infant, parent and operator in the same position as mentioned earlier. Elastomeric putty impression materials[8] unlike alginate, does not extrude deep into undercut areas in the region of the cleft. This helps during removal as it resists tearing and as a result, removal is atraumatic to the infant. Additionally, in a laboratory setting, the material remains dimensionally stable and permits accurate pouring of multiple casts. After the tray is removed, the oral cavity is inspected for any loose fragments of impression material.

A molding plate is then fabricated and inserted. The infant is instructed to wear the molding plate 24 hours a day for approximately 4-6 months. The molding plate causes no pain and is attached with small rubber bands taped to the face (Figure 2 and Figure 3).

Adjustments to the molding plate/nasal portion are done weekly or every other week depending on the progress. Each adjustment is very small, but it starts to guide the baby's gums, lips and nasal cavities as they are growing. Approximately, after a month, secondary impression was made using elastomeric putty impression materials and a nasal stent added to the moulding plate to lift the columella on the cleft side (Figure 4 and Figure 5).

At the conclusion of nasoalveolar molding (in unilateral cases, it is approximately four months and in bilateral cases, six months), the nasal cartilages, columella, philtrum and alveolar segments should be aligned to facilitate the surgical restoration of a child's facial features to normal configurations (Figure 6 and Figure 7).

DISCUSSION OF MANAGEMENT

The NAM technique uses an acrylic appliance to approximate the cleft and mold the nose reducing the amount of surgical correction required. The treatment goals are as follows-

- To restore the correct skeletal, cartilaginous and soft tissue relationship pre-surgically.
- To align and approximate the intraoral alveolar segments (greater/lesser segments).
- To correct the malposition of the nasal cartilages.
- To correct the nasal tip and the alar base on the affected side(s) as well as the position of the philtrum and columella.[3,9,5,6,10,11,12,13,14]

At birth, there is a high level of hyaluronic acid in the infant, which begins to fall off after 6 weeks of age.[15,16,17-23] The presence of hyaluronic acid in the body makes molding the tissue and bone more easy. This facilitates the-

- Active reduction of the cleft parts.
- Enlargement of the affected nostril (alar).
- Lengthening the area under the nose tip (columella).
- Lengthening of the skin under the nose to the upper lip (philtrum).
- Bringing the upper lip segments together.

When these facial areas are restored to a more normal size and position the following surgical connection of these cleft parts is vastly more normal in appearance.

Within the first 1-2 weeks after birth, an interdisciplinary cleft palate team evaluates the infant. A clinical examination is completed to determine whether or not the infant is a good candidate for NAM treatment. A full upper arch dental impression is taken to capture the intraoral cleft defect using a soft putty-type material in an infant-sized acrylic impression tray. A nasal impression is made to aid in the fabrication of a nasal stent and for comparison of the pre- and post-nasoalveolar molding results.

Treatment Stage One- Levelling and Aligning of the Alveolar Segments

One week after the molding plate with button is delivered, it is adjusted for ulceration or pressure sores.

Every 2 weeks thereafter, the plate is adjusted. Soft lining acrylic is added on one side and the hard acrylic is removed on the opposite side, actively moving the alveolar segments 2-3 mm/visit.

Cheek taping exerts an upward and backward force on the molding plate via orthodontic elastic bands; lip tape compresses the lip segments together.

The alveolar cleft is closed to less than 3-4 mm to attain a better anatomical base resulting in improved nasal support prior to placement of the nasal stent.

Treatment Stage Two- Implementation of the Nasal Stent

At this stage, the nose is molded to support the nasal tip and create tissue expanding forces.

It is modified at each visit to impart convexity to the alar cartilages.

The total treatment time for unilateral cleft cases is 2-3 months.

Bilateral clefts are more complicated and take somewhat longer.

Contraindications of Treatment-

- Severe systemic deficiencies.
- Risk of airway obstruction.
- Age of infant.
- Parental compliance.
- Cost.

Nasoalveolar Molding Team

The cleft palate team consists of surgeons, paediatric dentists, orthodontists, prosthodontists, psychologists, therapists, translators, geneticists, case managers and for some of our older patients, even makeup artists.[1,2,3,9,4,5,6,10]

Primary Cheiloplasty

The surgical procedure was a modified rotation-advancement cheiloplasty without nasal cartilage dissection. The incision line for the rotation flap was a Mohler incision. The incision for the advancement flap was along the cleft margin with no horizontal incision on the nasal floor or perialar extension. An L flap was developed based on the alveolus on cleft margin. The incision was extended along the piriform aperture to mobilise the alar base on the cleft side. The nasal floor was reconstructed with the combination of an inferior turbinate flap, an L flap and a CM flap on the noncleft side, also based on the alveolar margin. The columella was lengthened with the C flap. The orbicularis muscles on both medial and lateral lips were adequately released and repositioned. The alar base on the cleft side was advanced medially and superiorly. The vermilion was reconstructed with Noordhoff's vermilion flap. As the nasal shape was good after lip approximation, there was no cartilage dissection on the lower lateral cartilages during the repair. The lower lateral cartilage on the cleft side is supported by two alar transfixion sutures with 4-0 polydioxanone sutures. A silicone nasal conformer is used for 3 to 6 months after surgery.

Figure 8. Post Lip Surgery

Final Diagnosis

The long-term retention of nasal symmetry achieved by presurgical nasoalveolar molding was reported by Maull (1999). Presurgical nasoalveolar molding was shown to significantly increase symmetry of the nose. This increase in symmetry was maintained into early childhood. Gingivoperiosteoplasty has been shown to eliminate the need for secondary alveolar bone grafting in 60% of cases treated with presurgical orthopaedics (Santiago et al, 1998). The combined benefits of presurgical nasoalveolar molding and gingivoperiosteoplasty have been shown to reduce the overall cost of therapy from birth to adolescence (Pfeifer et al, 1998). Caries in the deciduous dentition were previously reported to be associated with molding plate orthopaedic treatment of infants with clefts (Bokhout et al, 1996a, 1996b, 1997; van Loveren et al, 1998; Prahl-Andersen, 2000). These studies were performed on the same study population of children with clefts at the University Hospitals in Amsterdam and Rotterdam. The orthopaedic molding appliances were used from shortly after birth through 18 months of age. It has been shown (Van Loveren et al, 1998) that lactobacilli and Streptococcus mutans required non-shedding surfaces (teeth or acrylic molding plate) to build up recordable levels. This cleft study population with a molding plate from birth through the eruption of the deciduous dentition (18 months) had oral conditions that were conducive to bacterial colonisation. In contrast to earlier forms of infant orthopaedics, unilateral nasoalveolar molding is concluded by 3 to 4 months of age and bilateral nasoalveolar molding is usually completed by 5 months. In both unilateral and bilateral treatment, the molding plate is not used after surgery. Therefore, there is a period in which the mouth is free of all non-shedding surfaces after completion of orthopaedic treatment and before eruption of the deciduous dentition at 6 months of age. Thus, children in the nasoalveolar molding population who have had 3 to 5 months of orthopaedic appliance wear are not likely to be at elevated risk for caries when compared with other children with clefts.[23,7,24-27]

It is important to recognise that state of the art gingivoperiosteoplasty changed in significant ways from its introduction by Skoog (1967) to the more current method of Millard and Latham. The Skoog technique required extensive subperiosteal dissection to achieve soft tissue closure of large alveolar cleft gaps. The current practice of gingivoperiosteoplasty is preceded by orthopaedic alveolar molding to close the gap and bring the cleft alveolar segments into passive contact. The strict association of presurgical nasoalveolar molding and alveolar gap closure allows gingivoperiosteoplasty to be performed confining subperiosteal dissection only to the cleft edges. Lee et al (1999) has demonstrated no significant growth disturbance in the first 10 years of growth when the presurgical alveolar gap is reduced to contact and a conservative Millard-type gingivoperiosteoplasty is performed in infancy. It is unlikely that the conservative neonatal gingivoperiosteoplasty would place this group at any additional risk of growth disturbance in the remaining years of growth when compared with the conventionally-treated cleft population, all of whom should have undergone secondary bone grafting by the age of 10 years.

The nasoalveolar orthopaedic plate was used in newborns with complete unilateral cleft of the lip and palate to correct osseous as well as soft tissue deformities.[17,18,19,20,21,22,23] Nasoalveolar molding plate improves alveolar position, i.e. approximation of the cleft alveolar segments, nasal symmetry, nasal septum alignment and nasal tip projection were achieved. The appliance being self-retentive is comfortable to wear. Extraoral attachments are not needed. It facilitates function and renders initial lip repair easy, more precise and tension free.[28,29]

CONCLUSION

Long-term studies on NAM therapy indicate better lip and nasal form, reduced oronasal fistula and labial deformities, 60% reduction in the need for secondary alveolar bone grafting. No effect on growth of midface in sagittal and vertical plane has been recorded up to the age of 18 yrs. In this case report, there was an active reduction of the cleft parts, enlargement of the affected nostril (alar), lengthening the area under the nose tip (columella), lengthening of the skin under the nose to the upper lip (philtrum) and we were able to bring the upper lip segments together and later the cleft lip was closed surgically.

With proper training and clinical skills, NAM has demonstrated tremendous benefit to the cleft patients as well as to the surgeon performing the repair.

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