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REVIEW PAPER

Nam Technique: An Overview

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ABSTRACT

Presurgical infant orthopaedics have been employed since 1950 as an adjunctive neonatal therapy for the correction of cleft lip and palate. Most of these therapies did not address deformity of the nasal cartilage in unilateral and bilateral cleft lip and palate as well as the deficiency of the columella tissue in infants with bilateral cleft. The nasolaveolar molding (NAM) technique a new approach to presurgical infant orthopedics developed by Grayson reduces the severity of the initial cleft alveolar and nasal deformity. This enables the surgeon and the patient to enjoy the benefits associated with repair of a cleft deformity that is minimal in severity. This article describes a clinical case report appliance design, clinical management and biomechanical principles of nasolaveolar molding therapy.

Keywords: *Cleft lip and palate, nasoalveolar molding, presurgical orthopaedics*

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INTRODUCTION

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 pediatric 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 towards the non-cleft side.

Presurgical nasal molding has also been introduced as an adjunctive neonatal management for preoperative correction of nasal deformities by utilizing the malleability of alar cartilage shortly after birth. Grayson et al. proposed the combination of presurgical orthopaedics and nasal moulding as a new technique called presurgical nasoalveolar molding for approximating the alveolar cleft and improving the nasal deformities preoperatively.[3]

SURGERY ALONE

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 moulding plate, we can often correct the nasal tip, the base on the affected side, as well as the position of the philtrum and columella.[4]

TIMING OF TREATMENT

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 and in medical economics.[4,5,6,7,8]

ADVANTAGES

- Improved feeding, growth guidance
- Development of palatal segments
- Minimization of treatment at a later age
- Normalization of tongue position
- Resulting in better speech
- Positive psychological effect on the parents
- Improved long-term nasal esthetics
- Reduced number of nasal surgical procedures
- Reduced need for secondary alveolar bone grafts in the majority of patients if gingivoperiosteoplasty is included in the protocol
- Savings in cost

IMPRESSION PROCEDURES

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.

The quality of a cleft lip and palate impression depends on two factors- complete inclusions of the lateral maxillary segments with a good reproduction of the muco-bucal 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 is fully awake without any anesthesia or premedication. Infants should be able to cry during the impression procedure and absence of crying may be indicative of airway blockage. The parent sits on a stool of adjustable height. The infant is 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 (**Figure 1**). The advantages of its use are, it can be removed before it sets in case of any emergency and it has excellent resistance to tearing. A wax spacer is adapted on the stone model on which a custom acrylic tray with a handle is prepared (**Figure 2**).[9]

Figure 1 Impression compound

Figure 2 Acrylic tray

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,[9] 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 will 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 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, lip, and nasal cavities as they are growing.

Figure 3 Molding Plate with rubber band and nasal stent

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.

TREATMENT DETAIL

The NAM technique uses an acrylic appliance to approximate the cleft and mold the nose, reducing the amount of surgical correction required.

TREATMENT GOALS

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.[4,10,11]

NEED FOR TREATMENT PRIOR TO 6 WEEKS OF AGE

At birth there is a high level of hyaluronic acid in the infant, which begins to fall off after 6 weeks of age. 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.

TREATMENT PROTOCOL

Evaluation

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 (**Figure 4**).

Figure 4 Nasal Stent

Treatment Stage One: **Leveling 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 **(Figure 5).**

Figure 5 Taping of the acrylic plate

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 (Figure 3)

- 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 FOR TREATMENT

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

NASOALVEOLAR MOLDING TEAM

The cleft palate team consists of surgeons, pediatric dentists, orthodontists, prosthodontists, psychologists, therapists, translators, geneticists, and for some of our older patients, even make-up artists.[1,2,4,5,6,7,10,12]

BILATERAL CLEFT LIP AND PALATE

The bilateral cleft lip and palate (**Figure 7**) deformity presents additional challenges for satisfactory surgical repair. The usual surgical approach to the correction of bilateral cleft lip necessitates a two-stage surgical repair of the short or absent columella and the excessively wide prolabium. Presurgical columella elongation combined with orthopedic retraction of the premaxilla and active alveolar molding has eliminated the need for the traditional surgical reconstruction of the columella. In the method of nasoalveolar molding and columella elongation, the posterior lateral alveolar ridges are molded to an appropriate width to accept the premaxilla. Using the molding plate in conjunction with external tape and elastics retracts the premaxilla. Bilateral nasal stents are extended into the nostril aperture from the vestibular flange of the intraoral molding plate. A band of soft acrylic presses against the naso-labialfold. The combined effects of pushing the nasal tip forward and pressing back on the naso-labial fold results in gradual tissue expansion and lengthening of the columella. At the same time, the domes of the lower lateral nasal cartilages are brought together in the midline, and the intranasal lining is expanded. A surgical correction of the nose is necessary to remove the fibro adipose tissue that is deposited between the widely separated nasal dome cartilages. The lip repair uses a straight-line approach on either side. Bilateral gingivoperiosteoplasties are performed if alveolar segments are touching at the time of surgery. Narrowing of the alar bases is greatly facilitated by preoperative premaxillary retraction. The combination of presurgical nasoalveolar molding and nonsurgical columella elongation allows bilateral cleft lip and nose correction in a single stage. This has been shown to result in an improved aesthetic outcome and reduced need for surgical revision before the age of secondary bone grafting.

RESEARCH STUDIES

Maull 1999 reported the long-term retention of nasal symmetry achieved by presurgical nasoalveolar molding. 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 orthopedics. The combined

benefits of presurgical nasoalveolar molding and gingivoperiosteoplasty have been shown to reduce the overall cost of therapy from birth to adolescence. In contrast to earlier forms of infant orthopedics, 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.

It is important to recognize 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 sub periosteal dissection to achieve soft tissue closure of large alveolar cleft gaps. Orthopedic alveolar molding to close the gap and bring the cleft alveolar segments into passive contact precedes the current practice of gingivoperiosteoplasty. The strict association of presurgical nasoalveolar molding and alveolar gap closure allows gingivoperiosteoplasty to be performed, confining sub periosteal dissection only to the cleft edges. 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 orthopedic plate was used in newborns with complete unilateral cleft of the lip and palate, to correct osseous as well as soft tissue deformities.[13,14,15, 16,17,18,19,20]

CONCLUSION

Long-term studies on NAM therapy indicate better lip and nasal form, reduced oro-nasal 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. 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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OBITUARY

Birth : 23 April, 1955
Death : 26 October, 2015

Prof. Abhininder Singh Thind has studied MBBS at Galancy Medical College, Amritsar and has worked at Govt Medical College Patiala as Professor and Head of Forensic Medicine. He was a very affectionate and loving colleague and received several award. Indian Congress of Forensic Medicine and Toxicology (ICFMT) conference held at Gurgoan in 2015 November has decided an oration in his memory form next conference onwards. Life time achivement award was given posthumously at ICFMT conference, 2015. He was also a member of International Advisory Board of IJHRMLP. We condoled his death and prayed to his highness that his soul rest in peace.

His wife received the life time achievement award at ICFMT conference at Gurgoan