



NASOALVEOLAR MOLDING: BOON TO CLEFT LIP AND PALATE PATIENTS – A Review

Orthodontology

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ABSTRACT

The nasolabial molding (NAM) technique could be a new approach to presurgical infant orthopedics that reduces the severity of the initial cleft alveolar and nasal deformity. This method facilitates the primary surgical repair of the nose and lip to heal under minimal tension, thereby reducing scar formation and improving the esthetic result. This paper reviews the essential principles of nasolabial molding therapy, numerous types of appliances used in this therapy, protocol followed, and a critical evaluation of the benefits and drawbacks of this technique. Universally authors have agreed the positive outcome of nasolabial molding for better esthetics once cleft lip and palate (CLP) repair, but the long-term effects of this therapy are yet to be substantiated. Despite a relative scarcity of high-level evidence, nasolabial molding seems to be a promising technique that deserves further research.

KEYWORDS

Nasolabial molding, Presurgical infant orthopaedics, Esthetics, Cleft lip and palate

INTRODUCTION

Cleft lip and palate along with nasal deformity is one amongst common anomalies occurring during the embryonic development of face.

The traditional treatment of cleft lip and palate involves multiple surgeries [2]. The surgical treatment of cleft lip and palate has been documented since AD 317, once when Chinese general Wei Yang-Chi had his cleft lip corrected by cutting and stitching the edges together. As surgical techniques advanced from the 1800s to 1900s, the main focus shifted to achieving precise muscle closure, delicate technique, and a far better aesthetic result [1].

The concept of presurgical orthopedic cleft molding was developed to additionally improve the aesthetic result of lip repair. Use of presurgical orthopedics is recorded as early as the eighteenth century. It is also suggested that nasolabial molding stimulated immature nasal chondroblasts, producing an interstitial expansion that is associated with improvement within the nasal morphology (Chondral Modeling Hypothesis, Hamrick 1999) [3].

Grayson et al and Cutting et al in 1993 first described the passive presurgical nasolabial molding, a wide accepted approach taken before cheiloplasty for newborns with cleft lip, alveolus and palate [4].

HISTORY⁵

In 317 AD, Chinese general Wei Yang-Chi corrected his cleft lip by cutting and suturing the edges. Several ways are accepted over the centuries to recover the site of the cleft alveolar segments.

1556 -Pierre Franco was the pioneer in elaborating the description of the indications, surgical technique, and post-operative care of the hare lip

1575 - Amboise Pare pioneered a technique by his name, which involves lip repair with cleft lip pins

1689 -Hoffmann elaborated the use of facial binding for constricting the cleft and prevention of postsurgical dehiscence

1790 -Desault used a similar technique in bilateral cleft patients, in which the maxilla was retracted before surgical repair.

1844 -Hullihen highlighted the significance of adhesive tape binding in presurgical preparation of clefts

1927 -Brophy documented the passing of a silver wire through both the ends of the cleft alveolus, and then gradually tightening the wire to approximate the ends of the alveolus before lip repair

1946 -Pritchard ascertained that the speed of bone healing was reciprocally related to the dimensions of the gap

1950 -McNeil used a series of plates to actively mold the alveolar segments into the pre-planned position

1952 -Tennison developed a method conserving the exact location of Cupid's bow

1958 -Burstone, further developed and popularized McNeil's technique

1960 -Millard's rotation advancement closure technique brought the Cupid's bow and the philtrum into a symmetrical position

1975 -Georgiade and Latham introduced a pin-retained active appliance to simultaneously retract the premaxilla and expand the posterior segments

1987 -Hotz described the use of a passive orthopedic plate for the alignment of the cleft segments

1993 -Grayson et al. described a new technique to mold the alveolus, lip and nose in cleft patients prior to surgery.

Principle of Nasolabial molding

Matsuo conducted the original research for molding cartilage. He documented that the cartilage in the newborn is soft and lacks elasticity. Matsuo used a pair of silicone tubes to shape the nostrils. But this device needed an intact nasal floor and was unable to direct the force since his stent expands circumferentially. Grayson further developed the nasal stent to extend from the anterior flange of an intraoral molding plate. The superiority of this method is that it enables the clinician to apply force to precisely shape the nasal cartilage and

lengthen the columella in bilateral cleft lip and palate patients. An added advantage of this was that, the presence of an intact nasal floor was not compulsory⁷.

Passive molding involves custom made acrylic moulding plate used gently to direct the growth of the alveolus⁵. In contrast, negative sculpturing includes serial modifications of the internal surfaces of the moulding appliance to get anticipated shape of the alveolus and nose⁶.

Indication and Contraindications of Nasoalveolar molding

Indications⁸⁻¹²

- Unilateral or bilateral cleft lip with or without palate
- Nasal defect and asymmetry
- Short and/or deviated columella
- Alveolar segments malposition
- Neonatal cleft patients
- Co-operative parents or caregivers

Contraindications¹²⁻¹³

- Unhealthy baby
- Lip and alveolar ridge are not severely malposed
- Low patient compliance
- Accessibility and socio economic status of the patient
- Technique sensitive

Advantages and Disadvantages of nasoalveolar molding technique

Advantages

- Approximates the alveolar segments as much as possible prior to surgery and repositions the premaxilla back into the position of the alveolar arch in bilateral cleft patients^{1,14-15}.
- Places a premaxilla in a relatively more anatomically correct position before surgical lip closure¹.
- Reduces the width of the defect¹⁶⁻¹⁷.
- Provides a comparatively ideal base for lip closure¹⁸⁻¹⁹.
- It lessens tissue tension throughout the surgical procedure, thereby allowing healed soft tissues to rest against a relatively normal bony anatomy¹.
- Economical¹.
- In unilateral cleft patients, the nasal stent is placed so that the columella and septum are molded to a more vertical and upright position to correct the deviation of the columella base to the non-cleft side. With cautious adjustments, the alar cartilage can be molded into a more normal convexity to obtain a bilateral symmetry without extensive soft tissue surgery or scarring^{16,20}.

Disadvantages

- Locked out segment^{11,21,22}
- Overexpansion of external nares^{21,22-23}
- Skin and mucosal irritation²⁵⁻²⁷
- Exposure of primary tooth bud²²
- Risk of airway obstruction due to dislodgement of the appliance²³
- Certain degrees of relapse of the molded cartilages to the initial position²⁴.
- Most common hard tissue complication associated with the presurgical nasoalveolar molding device is faulty direction of molding of the alveolar segments¹.

Objectives^{12,27}

- Decrease of the severity of hard and soft tissue deformities
- Improved esthetics following primary repair
- Approximation of the cleft lip segments as well as the medial and lateral sides of the nose.
- Projection and redirection of the nasal tip while correcting the corresponding deformity of the lower lateral alar cartilage.
- Betterment of nasal symmetry in complete unilateral cleft lip and palate till the age of 9 years.
- Minimize surgical scar formation.

Impression technique

ONE-STEP IMPRESSION²⁸

The low-viscosity material Identium light® (Kettenbach GmbH & Co. KG, Eschenbach, Germany) is based on vinylsiloxane ether and is applied in a double-mix technique. It is odorless and tasteless.

The one-step technique is relatively tougher than two-step impressions, since the intraoral impression tray has to be fixed while

simultaneously impressing on the extraoral parts to approximate the latter. There is a chance of slippage and disturbances through under-cut areas, leading to a faulty impression, which is more common than in the two-step procedure

TWO-STEP-IMPRESSION²⁸

A double-mix impression with Xantopren® for the cleft palate and Memosil® (both Heraeus Kulzer GmbH, Hanau, Germany) for the cleft-lip-nose complex is used.

Grayson and Shetye placed the infant upside down while making the impression. The impression tray is inserted into the oral cavity¹.

Prasanth et al. and Retnakumari et al. used heavy body silicone impression while the infant was placed in supine position during the procedure¹

Dubey et al. kept the baby in mother's lap with head posing downward and her hands supporting baby's chest and lap region while making the impression¹.

Karimi et al. used the conventional impression compound to take the primary impression¹.

Splengler et al. took intraoral and extraoral alginate impression with the patient under general anesthesia. This method is legit not recommended as the patient is subjected to hospitalization merely for an impression procedure¹.

Fabrication of NAM appliance

The NAM plate designed by Grayson and Shetye¹¹ comprises of hard, clear self-cure acrylic. A retention button is fabricated and positioned anteriorly at an angle of 40 degree to the plate. The vertical position of the retention arm should be at the junction of the upper and lower lip. The retention button accurately secures the molding plate in the mouth with the help of orthodontic elastics and tapes. A tiny opening of 6-8 mm in diameter is made palatally on the molding plate to provide an airway in case the plate gets dislodged posteriorly. This is the most commonly used NAM appliance.²⁹⁻³¹

Different materials have been substituted for autopolymerizing resin to be used in appliance by various researchers. They are: light-cure polymerizing material (Yang et al.³²), heat-cure polymerizing material (Ma et al.,²³ and Karimi et al.³³) as well as thermoplastic base plate wax (Upadhyay et al.³⁴).

Insertion of appliance

The appliance is secured extraorally to the cheeks and bilaterally by surgical tapes with orthodontic elastic bands at one side. The elastic on the surgical tape is encircled on the retention arm of the molding plate and the tape is secured to the cheeks. The elastics (inner diameter 0.25 inch, wall thickness heavy) should be prestretched approximately 2-3 times their lumen diameter for proper activation force of about 100 g. Additional tapes may be required to secure the horizontal tape to the cheeks.^{21,23} Some authors suggest using liquid adhesive on cheeks to secure the Steri tapes for better retention of the appliance.³²

Alternatively, denture adhesive and tape-elastic system has been used by Shetty et al.³¹

Adjustment of the appliance¹

The child is seen weekly to make adjustments to the molding plate to bring the alveolar segments together. At one visit not more than 1 mm of modification (addition or reduction) of the molding plate should be made.

Incorporation of nasal stent

A silicone nasal conformer suggested by Matsuo and Hirose³⁵ can be used as a tool for presurgical nasal molding when the patient has an incomplete cleft lip. The height of the conformer can be attuned by progressively adding some soft resin or flat silicone sheets on the domes. This is a method to increase the columella height subsequently by adding silicone sheets to the domes of the nasal stent. It can be used for presurgical elongation of the columella in incomplete clefts or postoperative maintenance of the nostril configuration. The drawbacks in this method are previously mentioned, which include the need for an intact nasal floor and the inability to direct the force because the stent expands circumferentially¹.

Instructions for the parents⁷

- Parents should be well motivated and adequately educated.
- They should be instructed to keep the plate 24x7, and to remove it for cleaning as needed, every day.
- Tapes and elastics are changed daily.
- They are asked to apply baby cream over cheeks while changing tapes.
- They are asked to examine the baby's mouth regularly for any ulceration.

Complications with application of nasoalveolar molding technique

Grayson and Maull¹⁰ noted complications on nasal and oral mucosa and on the cheeks mostly due to irritation from uneven pressure of the appliance where tape is attached. They also warned to avoid the chance of the appliance being dislodged into the mouth with risk of airway obstruction.²⁶

Benefits³⁷

- As the cleft is reduced in size before surgery; an improved post-surgical prognosis is expected.
- It diminishes the number of surgical revisions for excessive scar tissue, oronasal fistulas, and nasolabial deformities.
- Improved long-term nasal esthetics & reduced number of nasal surgical procedures.
- Permanent teeth have an enhanced possibility of eruption owing to the approximation of alveolus.

Conclusion

Eversince the beginning of nasoalveolar molding, there has been a significant betterment in the outcome of the primary surgical cleft repair. Medical practitioners especially paediatricians should be made well aware of the nasoalveolar molding therapy and its benefits that nasoalveolar molding plates are not only feeding plates, but they also mould nose and alveolus.

The mouldability of the perioral structures in the early age is utilized for selective control of growth patterns with the use of nasoalveolar molding techniques, which assist as an adjunct to the surgical procedures; producing better esthetics and reliable prognosis.

Gingivoperiosteoplasty along with primary lip repair resulted in much better outcomes. Hence in today's date, a thorough understanding of the changing concepts regarding nasoalveolar molding and timing of the initiation of the treatment is of utmost importance for early and successful rehabilitation of the cleft.

But these studies have some inherent drawbacks as they are performed on small sample size and they lack a control group.

Furthermore, long-term effects of nasolaveolar molding have not been followed up, which is compulsory to validate the benefits of presurgical nasoalveolar molding.

Although, initial follow-up investigations are recently being conducted. Nasoalveolar molding has proved to be an efficient method for plummeting cleft width and improving nasal shape and symmetry in uni- and bilateral clefts.

Inspite of the conflicting opinions about the long-term success of nasoalveolar molding, the immediate success of the therapy is remarkable. Although lip closure can always be achieved surgically, it reduces tissue tension and therefore improves post-surgical outcome by minimizing wound healing disturbances and scar formation.

The chair-side time reduction is attained by the use of the preformed plates delighted both the physicians and the parents.

Improving nasoalveolar molding awareness and providing support can remarkably facilitate the entire process that are faced by parents and clinicians throughout this treatment phase emphasizing the importance of their role for successful cleft lip and palate nasoalveolar molding results.

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