Review Article:

Presurgical Nasoalveolar Molding: A Narrative Review of Early Management in Newborn Patient With Cleft Lip and Palate

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ABSTRACT

Context: Orofacial clefts are among the most common congenital birth malformations in the oral and maxillofacial area. Lip reconstruction or cheiloplasty is a critical issue for these patients when they are around three months old. Presurgical Nasoalveolar Molding (NAM) has become part of the treatment protocol in many cleft centers to improve the treatment outcome. This procedure is commonly employed to reduce the alveolar segments into proper alignment and improve nasal symmetry in patients with cleft lip and palate.

Objective: This article aims to review the value of this technique as part of the treatment protocol for infants born with cleft lip and palate.

Data Sources: In this review, the electronic databases of ISI, PubMed, and Google Scholar were searched. Articles published from 2000 to 2018 were retrieved and underwent "abstract" and "full-text" appraisal. The following keywords were used: "Nasoalveolar Molding", "cleft lip and palate", "presurgical orthopedics", and "nasal stent".

Results: Presurgical NAM can reduce the severity of the initial cleft deformity, wherein the bony segments are slowly moved to a more favorable position, lessening the amount of surgical correction needed to bring the lip segments together, while simplifying the surgical approach for the nose.

Conclusions: By using presurgical NAM, the primary surgical repair of the lip and nose is performed under minimal tension, thereby reducing scar formation and improving the esthetic results. Also, the frequent surgical intervention to achieve the desired esthetic results can be avoided by this technique.

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1. Context

Cleft Lip and Palate (CLP) is defined as incomplete tissue formation of the lip, alveolus, and soft and hard palate. The defect ranges from a small notch in the lip to a full cleft spreading into the roof of the mouth and nose (1). It is the most prevalent structural abnormality that occurs during embryonic development and involves multiple professions to achieve satisfactory treatment outcomes (2). The orthodontist is a member of this interdisciplinary team, delivering presurgical orthopedics and orthodontic treatments (3).

Several modern presurgical infant orthopedic methods have been introduced to treat CLP, beginning with McNeil in 1950, followed by Georgiade and Latham, Hotz et al. Matsuo et al. and Nakajima et al. (4-8). In 1993, Grayson et al. described presurgical Nasoalveolar Molding (NAM), which addressed not only the alveolus but also the lip and the nose (9). The NAM appliance is a modern presurgical orthopedic device that allows for positive growth of the alveolar ridges into a better arch shape as well as reshaping of the flattened nose into a more symmetrical profile. Because of the presurgical appliance, the nose and lip can heal with the least tension, so decreasing scaring, which would result in better esthetic outcomes. Therefore, surgical morbidity risks and the costs of secondary scar operations decrease (8). In the present study, we have reviewed the value of presurgical NAM as part of the treatment protocol for infants born with CLP.

2. Objective

To review the literature, we searched the international databases, including ISI, PubMed, and Google Scholar, using the keywords “NAM”, “cleft lip and palate”, “presurgical orthopedics”, and “nasal stent” from 2000 to 2018. All of the articles (either case-control, cross-sectional, clinical trials, or review articles) were in English only, and the “abstract”, “brief”, and “full-text” that directly discussed presurgical NAM in newborn patients with CLP were selected. Next, the duplicated and irrelevant studies, abstracts, and articles in languages other than English were excluded from the review process.

3. Result

We found 25 articles related to presurgical NAM. In the following, the qualitative results of the reviewed articles are discussed.

3.1. Psychological, anatomic, and surgical challenges

The birth of a child with a cleft can be a traumatic experience for families. Such family members may feel intense feelings of discontent, vulnerability, concern, and distress. In newborns with CLP, the nose, lips, and maxillary arch are usually severely malformed and asymmetric. In those with unilateral CLP, the main challenges in reconstruction are asymmetric nostrils, deviated septum, and distorted maxillary arch form (10). In absence of a gold operation technique for treating nasal deformity, several nasal surgical alterations are often required to arrive at near nasal symmetry. In bilateral CLP, the deficient columella and ectopic premaxilla are the chief concerns in reconstruction, and severe scarring at the columella prolabial junction and lack of nasal projection are common outcomes because of the numerous nasal operations (11).

3.2. Presurgical Nasoalveolar Molding (NAM)

Presurgical NAM is a non-surgical technique used to reshape the gums, lips, and nostrils before the CLP surgery to reduce the degree of the cleft; moreover, it is painless and easy to perform. Before NAM, reconstructing a large cleft necessitated numerous operations starting from birth and continuing through adolescence, placing the patient at risk for psychological and social adjustment issues. However, following the emergence of NAM, the orthodontist can decrease the size of the cleft and shape the alveolar and nasal tissues into the right anatomic position (12). This technique involves active shaping and changing the placement of the alveolar processes, retracting and centering the premaxilla, approximating the lip segments, lengthening the columella, improving the nasal tip projection by adjusting the plate and using nasal stents and tapes (13).

3.3 The technique of NAM

To make the NAM appliance, first, a maxilla dental cast of the newborn is used to make a removable orthodontic acrylic alveolar molding (Figure 1). The first impression of the CLP infant is obtained within the first week of birth with heavy-bodied silicone. To do this, the surgeon holds the infant in an inverted position, and the impression tray is placed into the oral cavity. The infant is held in this position to inhibit the tongue from rolling back and to permit liquids to drain out of the oral cavity. To fabricate the cast, the dental stone is put into the impression. The resulting cast is then used to make the molding plate. The plate is composed of hard, clear self-cure acrylic (14).

Next, a retention button is made and placed anteriorly at a 40° angle to the plate. In the unilateral cleft, only one retention arm is used. The precise position of the retention arm is decided at the chair side. It is placed in such a way that not to disrupt the process of bringing the cleft lips together. The vertical placement of the retention arm should be at the intersection of the upper and lower lip.

A slight opening of 6-8 mm in diameter is created on the palatal surface of the molding plate to allow for an airway in case the plate falls posteriorly. Fabrication of the nasal stent is made after the cleft of the alveolus is reduced to about 5-6 mm in width (15). Using surgical tape with orthodontic elastic bands at one end, the appliance is fastened extraorally to the cheeks. Skin barrier tapes on the cheeks are recommended to prevent irritation on contact with the cheeks. The elastics (inner diameter 0.25 inch) should be stretched approximately two times their resting diameter for proper activation force. Parents are directed to keep the plate in the mouth at all times and to only take it out for daily cleaning.

The infant should be visited weekly to modify the molding plate and bring the alveolar segments together. The modifications are done by carefully taking out the hard acrylic and putting the soft denture base material on the molding plate. More than 1 mm of adjustment of the molding plate is not advised during each visit. The alveolar segments should be directed to their ultimate and optimal position.

The nasal stent component of the NAM appliance is amalgamated when the width of the alveolar gap is reduced to about 5 mm. The stent is 0.36 inch long in the shape of a "swan neck" made of round stainless steel wire. It is adhered to the labial flange of the molding plate, near the bottom of the retention arm. The hard acrylic component is molded into a bilobed form similar to a kidney. A layer of soft denture liner is placed on the hard acrylic for comfort. The upper lobe enters the nose and carefully brings forward the dome until a modest amount of tissue blanching is apparent. The necessary length to do the molding therapy is dependent on the degree of the initial cleft defect (15).

3.4. Objectives of NAM

The main objectives of NAM in patients with bilateral cleft are facilitating intra-oral feeding; improving maxillary growth; improving the projection of the nasal tip; reducing nasal deformity; increasing the surface area of the mucosal lining; improving columella lengthening and uprighting; facilitating primary lip, nasal, and alveolar surgeries; and retracting and repositioning the premaxilla more posteriorly (16).

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Figure 1. Nasoalveolar molding appliance

3.5. Advantages of NAM

The advantages of NAM include psychosocial relief of the infant's family. Preliminary findings indicate that the frequent visits for NAM adjustments reduce the anxiety felt by the caregiver and lead to a sense of empowerment. NAM also reduces the overall cost of cleft care by reducing the number of subsequent nasal revisions (17). NAM exploits cartilaginous plasticity and pliability, which is assumed to last during the first three months of an infant's life because of elevated estrogen and hyaluronic acid levels (18). NAM allows gingivoperiosteoplasty during initial lip repair in over 90% of infants and eradicates secondary alveolar bone grafts in over 60% of patients (19). It has been postulated that NAM lessens tension on lip closure, as well as permitting some nasal correction that would otherwise be statistically impossible simply with the operation.

The combined benefits of enhanced nasal symmetry and appearance and decreased number of nasal and dentoalveolar procedures result in considerable financial savings and psychological wellbeing of the patient and family (20). Furthermore, no effect on the growth of midface in the sagittal and vertical plane has been recorded up to the age of 18 years in patients who have undergone this procedure (18).

3.6. Disadvantages of NAM

The primary shortcoming of the NAM technique is neglecting nasal cartilage deformity during cartilage plasticity. Ignoring severe nasal cartilage deformity during this period usually leads to more surgical revisions (21).

Moreover, lip taping or surgical lip adhesion alone may not be the best procedure for patients with bilateral CLP. If the alveolar segments cannot be controlled, then the premaxilla can descend vertically, and the anterior aspect of the posterior alveolar segments can collapse palatally (20).

This outcome can result in an impinging deep bite of the premaxilla, arch form collapse, and impaired coordination with the mandibular arch (22). In addition, the malpositioned premaxilla can render fistula closure difficult. A persistent fistula can negatively impact speech production and make it possible for oral contents to enter the nasal cavity. These conditions lead to challenges in surgical reconstruction, orthodontic management, and speech therapy (21). Another disadvantage of surgical lip adhesion is the increased trauma, morbidity, and associated operational costs for the patient and family (23).

3.7. Common complications of NAM

The most common problem seen in NAM therapy is the irritation of the intraoral tissues of the oral mucosa, gingival tissue, or nasal mucosa, which can become ulcerated because of the severe pressure applied by the appliance. These ulcers are commonly found in the oral vestibule and on the labial side of the premaxilla (24). Therefore, it is recommended that the oral and nasal cavities of the patient be meticulously examined on each visit for such ulceration.

In the event of irritation, the necessary adjustments should be made to the molding plate to relieve sore spots. Also, the intranasal lining of the nasal tip is susceptible to becoming irritated under excessive pressure by the upper lobe of the nasal stent. The area under the horizontal prolabium band is also in danger of forming ulcers as well if the band is too tight. Another area of tissue irritation is the cheeks. Extreme care should be taken while removing the cheek tape to avoid any irritation to the skin; thus, skin barrier tapes are recommended. Slight relocation of the tape during treatment is also recommended to provide rest to the tissues in case they become irritated. Using an aloe vera gel on the cheeks to avoid irritation is also recommended when changing tapes (12).

4. Conclusion

NAM therapy is useful not only for the induction of dental alveolar growth but also as a presurgical orthodontic treatment to improve the nasal shape and better treatment results after the primary lip operation. Although it is necessary to evaluate the long-term stability of these effects, it can be concluded that the use of NAM is desirable during the postnatal period when the nasal cartilages show high plasticity, and this approach could provide right nasal shapes in patients with cleft lip and palate.

Ethical Considerations

Compliance with ethical guidelines

There is no ethical principle to be noted doing this research.

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Authors' contributions

All authors contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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