



Nasoalveolar molding in cleft lip and palate, a review of literature

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ARTICLE INFO	ABSTRACT
<p>Article Type: Review Article</p> <p>Received: 1 May 2014 Revised: 3 Jun 2014 Accepted: 11 Jul 2014</p> <p>*Corresponding author: Mahsa Mortazavi Department of Orthodontics, School of Dentistry, Islamic Azad University, Khorasgan Branch, Isfahan, Iran.</p> <p>Tel: +98 21 84902473 Fax: +98 21 84902473 Email: mahsa_mortazavi@hotmail.com</p>	<p>Nasoalveolar molding represents a paradigm shift from traditional presurgical orthopedics in the care of cleft lip and palate patients which has been applied increasingly in the past two decades. This article is a review of recent literature apropos of objectives, appliances, complications and short and long term effects of this technique.</p> <p>Keywords: Cleft lip and palate, Nasoalveolar molding.</p>

Introduction

Clefts of lip and palate occur in approximately 2.14 per 1000 live births in Iran and are the fourth most common craniofacial defects [1,2]. One of the most challenging parts of these patients' treatment is reconstruction of the facial soft tissue contours; lip and nose. Various surgical techniques for correction of cleft lip have been described by different authors (e.g. Pierre Franco 1556, Ambrose Paire 1575, Tennison 1952, Millard 1960), but wide and bilateral clefts still represent a significant challenge to achieve functional and cosmetic results [3]. Presurgical infant orthopedics was introduced to address these challenges. The goals of original techniques and appliances were to exert control over the floating premaxilla and align the maxillary alveolar processes. This was believed to reduce the tension on the lip and simplify or even eliminate subsequent orthodontic treatment

and thus became popular as an early intervention in the 1960s and 1970s [2, 4-6]. Although later studies showed that the initial results of lip repair were easier to attain with cosmetic improvement, it has no long-term benefit on the growth of the midface and dentoalveolous. The results have been considered similar to those produced by surgical lip adhesion or even early muscle repair [2,4]. Nevertheless, when premaxilla protrusion is caused by a bilateral cleft lip, using these appliances make definitive lip repair much easier for surgeon [7]. The current article is a review of recent literature regarding aims, types and complications of infant nasoalveolar molding to improve practice of presurgical infant orthopedics.

Presurgical orthopedics or neonatal orthopedics is initiated during the first or second weeks following birth unless complications arise from other congenital anomalies or medical problems



Figure 1. Active presurgical orthopedic appliance (from Krishnan V, Davidovitch Z: *Integrated Clinical Orthodontics*. Hoboken, New Jersey: Wiley-Blackwell; 2012).

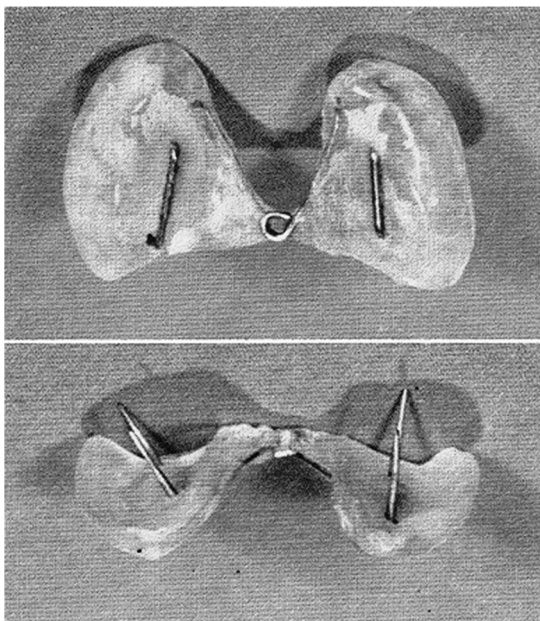


Figure 2. An active presurgical orthopedic appliance was designed by Georgiade (From Georgiade N: *Cleft Palate J* 7:411-8,1970).

[2,8,9]. A major drawback of the presurgical orthopedics is that it has no effects on nasal architecture; thus, good retraction of premaxilla could not be achieved until nasal extensions are added to alveolar molding plate [4,10]. The presurgical nasopalveolar molding (NAM) introduced by Grayson, consists of active molding of alveolar process as well as the surrounding soft tissues and nasal cartilage [11,12].

According to Matsuo, the maternal estrogen level is highest immediately after birth, which increases hyaluronic acid in the neonatal cartilage and responsible for the highest degree of plasticity [12,13]. Results of a study performed by Matsuo et al showed that if NAM was performed during the first week of life in a

neonate and retained for 3 months, nasal shape and symmetry would be superior to those conventionally operated on about 3 months of age, following observation for 12 months or longer [14]. Other authors also believe that NAM should be initiated as soon as possible, preferably within the first month of life, and will take 2 to 4 months to become complete [4,12].

Objectives of NAM

The main objective of NAM is to reduce the severity of the initial cleft deformity (15). However, other goals that can be achieved with NAM are as follows:

- Active molding and repositioning of deformed nasal cartilage and alveolar process.
- Lengthening of columella.
- Placement of lip segments in a more anatomically correct position without lip adhesion and scarring.
- Reducing the number of surgical procedures and thereby reducing costs.
- Reducing the need for secondary alveolar bone grafts.
- More favorable bone formation by reducing the size of cleft (because bone healing is inversely proportional to the size of cleft).
- Serving as an obturator to help infant generate suckling force [3, 14-16].

Appliances

From 1950 that McNeil introduced the modern concept of presurgical maxillary orthopedics until now that nasopalveolar molding is the dominant and preferred approach, many different types of neonatal maxillary orthopedic appliances have been described in the literature. These appliances could be categorized as active, semi-active and passive devices or intra oral or extraoral appliances [3,17].

Active appliances have active components such as spring or screw that apply force to alveolar segments and move them in a predetermined manner (Figure 1) [17]. Georgiade (1968) and Latham (1980) introduced two types of these appliances (Figure 2, 3) [18,19].

Semi-active appliances are constructed by sectioning the dental cast, and reorienting the maxillary segments in a more favorable position.

The plate is fabricated on the constructed cast

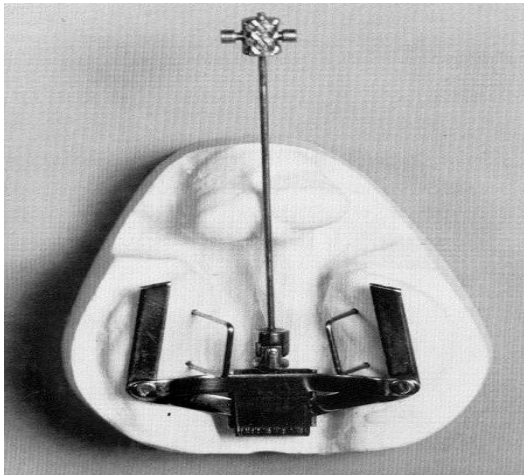


Figure 3. An active presurgical orthopedic appliance was designed by Latham (From Latham RA et al, Cleft Palate J 13:253-61, 1976).

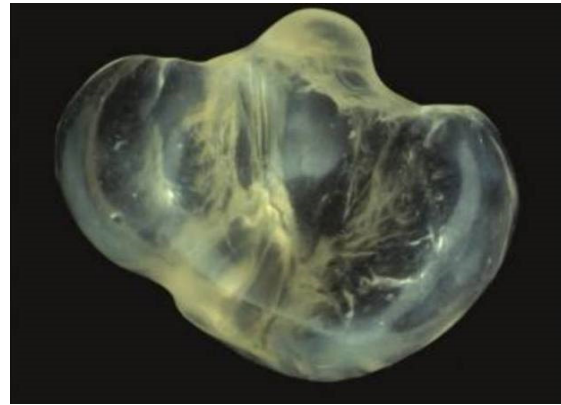


Figure 5. Passive presurgical orthopedic appliance (from Krishnan V, Davidovitch Z: Integrated Clinical Orthodontics. Hoboken, New Jersey: Wiley-Blackwell; 2012).

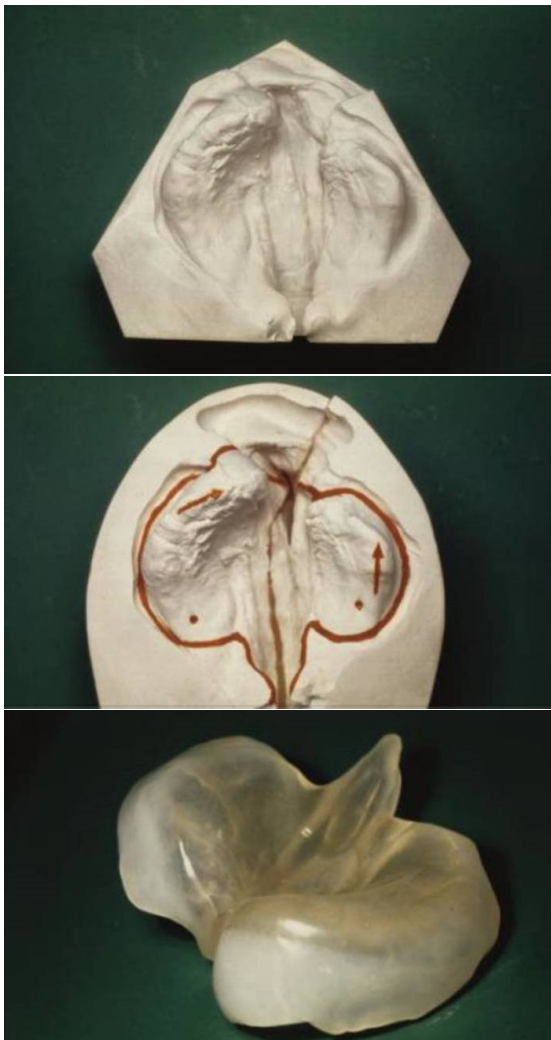


Figure 4. Semi-active presurgical orthopedic appliance (from Krishnan V, Davidovitch Z: Integrated Clinical Orthodontics. Hoboken, New Jersey: Wiley-Blackwell; 2012).



Figure 6. Nasoalveolar molding appliance. (From <http://www.cleftsmile.org/nasoalveolar-molding-nam>).

and forces the palatal segments in a predetermined direction when placed in oral cavity (Figure 4) [17].

And finally, passive appliances are supposed to induce arch alignment during growth by grinding away acrylic material in certain areas of the palate, to ensure proper spontaneous development of the segments and also to prevent collapse of the cleft segments (Figure 5) [17,20].

The nasoalveolar molding appliances consist of an intraoral molding plate with nasal stents to mold the alveolar ridges and nasal cartilage concurrently. The stent is inserted into the affected nostrils at night during baby sleep to apply atraumatic pressure on the nasal tissues in order to reshape, expand and reposition the external nasal structures. Besides, intraoral plate can reposition and realign the palatal segments (Figure 6) [20].

Complications

The most common problem with the NAM

therapy is irritation of the oral mucosa (vestibule, oral side of premaxilla and cheeks), gingival tissue and nasal mucosa. These problems are probably caused by applying too much force by the appliance [21]. Therefore, we suggest that careful examination and proper adjustment of the appliance would prevent these side effects.

Fungal infection is another complication that can occur because of poor oral hygiene and fulltime wearing the molding plate. This can be treated by local Nystatin or systemic Amphotericin [3].

Short and long-term effects

Many researchers reported possible short-term positive effects of nasoalveolar molding such as: significant reduction in cleft width, increase in arch circumference, reduction in premaxillary protrusion and deviation, correcting maxillary midline, improving nasal symmetry, increasing columellar length and width [22-29].

Singh et al recommended slight overcorrection of the alar dome on the cleft side to maintain the NAM results [26]. Baek and Son in a 3D analysis evaluated alveolar molding and growth effects in unilateral cleft lip and palate patients and concluded that these effects take place in the anterior and posterior alveolar segments, respectively [28].

Yu et al reported a reduction in alveolar height of infants with unilateral cleft lip and palate who were treated with computer aided design-nasoalveolar molding (CAD-NAM). They concluded that the traction force of the appliance may have an inhibitory effect on the vertical growth of the alveolar bone [22].

Despite the existence of several published papers about short term effects of NAM, there is limited evidence for the long-term effects of this treatment modality. Yet the limited existing literature shows controversial results. Maul et al reported that the increase in nose symmetry attained by NAM was maintained till early childhood [26]. However, Liou et al performed a 3 year follow up study and reported relapse of columella length in some patients during the first and second year after lip surgery [24]. Similarly, Pai et al reported relapse of nostril shape in some of their 57 patients at first year of life [23]. Yet, more investigations are needed to reach a consensus regarding the long-term effects of nasoalveolar molding.

Conflict of interest: The authors declared no conflict of interest.

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