Use of Nasoalveolar Molding Appliance to Direct Growth in Newborn Patient With Complete Unilateral Cleft Lip and Palate

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Abstract

The alignment of the alveolar segments creates the foundation upon which excellent results of lip and primary nasal surgery are dependent in the repair of the cleft lip and palate patient. The purpose of this article is to illustrate the step-by-step fabrication process of the nasoalveolar molding appliance used to direct growth of the alveolar ridge, lips, and nose in the presurgical treatment of cleft lip and palate. As a result of this appliance, the primary surgical repair of the nose and lip heals under minimal tension, thereby reducing scar formation and improving the esthetic result. (*Pediatr Dent*. 2003;25:253-256)

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The surgical treatment of cleft lip and palate has been documented since AD 317, when Chinese general Wei Yang-Chi had his cleft lip corrected by cutting and stitching the edges together. In 1556, Pierre Franco gave the first detailed description of the indications, surgical technique, and postoperative care of the cleft lip. Later in 1575, Ambroise Pare pioneered a technique that bears his name involving lip repair with cleft lip pins. His method involved fastening the lip edges together with a needle wrapped with a horsehair.[1] As surgical techniques advanced from the 1800s to 1900s, the focus shifted to achieving precise muscle closure, delicate technique, and a better esthetic result. For example, Tennison developed a technique preserving the accurate position of Cupid's bow in 1952.[2] Moving towards the present, Millard's rotation advancement closure technique (in the 1960s) brought the Cupid's bow and the philtrum into a symmetrical position. This technique focused on preserving the esthetic sub-unit of the lip by rotating abnormally elevated lip structure into a normal position, producing a more anatomic closure with better patient satisfaction.[3]

To further improve the esthetic result of lip repair, the concept of presurgical orthopedic cleft molding was developed. In complete unilateral cleft lip, the use of the presurgical appliance helps provide a more coalescent cleft and an ideally shaped alveolar arch form. This, in turn, diminishes tension during the primary surgery, making scar formation more difficult. The alignment of the alveolar segments also creates the foundation for good lip symmetry.

Use of presurgical orthopedics are recorded as early as the 18th century. In 1946, Pritchard observed that the rate of bone healing was inversely proportional to the size of the gap. Due to this reason, use of presurgical orthopedics may produce more favorable bone formation by reducing the cleft gap.[4]

The most well-known appliance was designed by Georgiade and Latham in 1975. This device expanded collapsed lateral segments while actively retracting the premaxilla in bilateral cleft lip and palate infants. This Latham appliance used a pinned screw mechanism and extraoral activation to achieve a desired result.[5]

In addition to the lip and alveolus, most cleft surgeons today recommend correction of the cleft lip nasal deformity at the time of primary lip repair. This deformity is characterized by a flattened nasal alar cartilage on the side of the cleft that is splayed out by the alveolar gap. The

Figure 1. (From left to right) A pretrimmed customized tray, an impression taken with the tray, and a poured cast.

Figure 2. (From left to right) A locked-out cast, a Triad trimmed on cast, and a nasoalveolar molding appliance finished and polished.

Figure 3a. Materials used to fasten a nasoalveolar molding appliance.

Figure 3b. A nasoalveolar molding appliance placed and fasted by Steri Strips and elastics.

deformity has been addressed by both surgical and nonsurgical means. In the 1980s, Matsuo discovered that nasal deformities in the early infancy can be corrected nonsurgically by molding the cartilage. He found that the nostril on the side of the cleft could be shaped more symmetrical to the non cleft side by reshaping the alar cartilages in the unilateral cleft lip and palate patient.[6] This allows the surgeon to definitively correct the nose, without extensive dissection.

Grayson and Cutting were one of the first to combine the concepts of presurgical orthopedics and preoperative treatment of the cleft lip nasal deformity. They developed the concept of nasoalveolar molding, which combined a nasal molding stent with a passive, presurgical molding appliance in treating cleft lip and palate infants. The retrospective study of Santiago et al shows that a significant decrease in alveolar cleft size results in a diminished need for bone grafting during the mixed dentition stage.[4]

Nasoalveolar molding is the nonsurgical, passive method of bringing the gum and lip together by redirecting the forces of natural growth. It is nonpainful and easy to use. It also allows for correction of the flattened nose prior to surgery and facilitates nose repair at the time of lip repair.

The purpose of this article is to describe the step-by-step fabrication process of the presurgical nasoalveolar molding orthopedic appliance used to direct growth of the alveolar ridge, lips, and nose in patients with unilateral cleft lip and palate.

Technique

There are several steps involved in the fabrication of a nasoalveolar molding appliance.

Impression

Nasoalveolar molding is initiated postpartum, after discussing the process, risks, and benefits with the parents. Alginate impressions are taken using a pretrimmed customized pediatric tray (Figure 1). Utility wax is employed to avoid any sharp edges on the tray and to better adapt to the newborn's mouth. The impression is taken with the baby in the most upright position, being held by one of the parents. Caution is taken to avoid any airway obstruction. The cast is poured

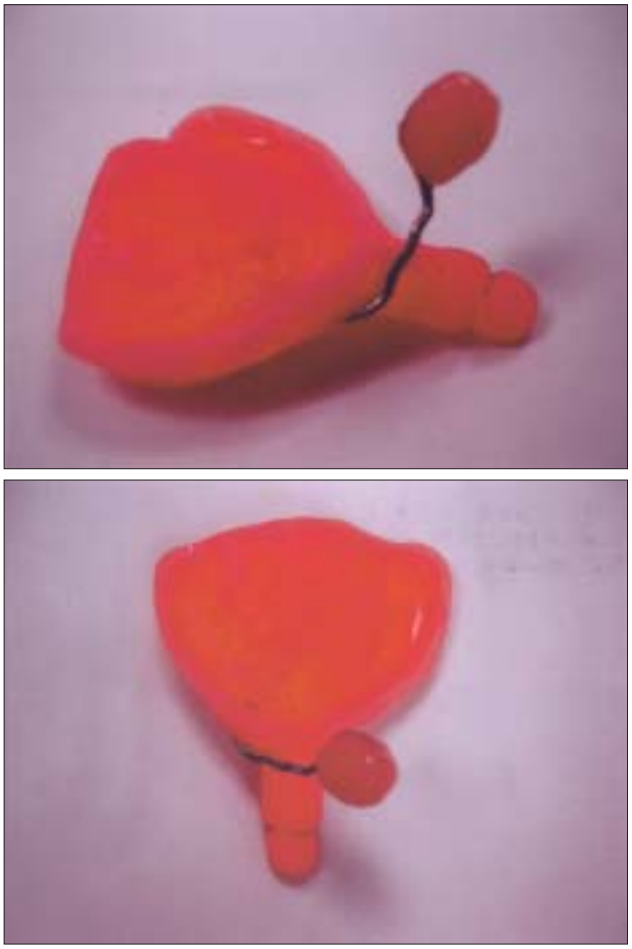

Figure 4a. A nasoalveolar molding appliance with nasal stent.

from the impression with plaster of paris and then trimmed. The initial gap is measured with a caliper and ruler and recorded in the patient's chart.

Appliance fabrication

Undercuts on the cast are blocked out with utility wax. Separator media or Vaseline is then applied to the cast to prevent locking of the appliance to the cast after curing. The cast is then ready to receive the Triad material (Dentsply International Inc, Milford, Del). Pink Triad is preferred over blue Triad because it has a more natural appearance. Triad is placed and adapted to the cast. A 5 mm × 10 mm pin-shaped handle is made with Triad and placed at a 30-degree angle to the palate. Excess Triad is trimmed and the cast is then light cured. After curing, a notch is made at approximately 3 mm from the tip of the handle to grasp the elastics. Finally, all surfaces are smoothed. Smooth surface of the appliance is important in preventing ulceration. A good assurance is to let the parents check for any roughness (Figure 2).

Appliance insertion

The appliance is ready to be worn for 1 week. This period allows for acclimation of the patient and parents to the

Figure 4b. A patient wearing an appliance with nasal stent.

prosthesis. The appliance is inserted in the same fashion as a denture–by sliding one side in first, and then the other. Next, a liquid adhesive such as Mastisol (Ferndale Laboratories Inc, Ferndale, Mich) is painted with a cotton-tipped applicator horizontally on the cheeks where the Steri Strips will be placed. Afterward, the elastics are stretched as far as possible so that the entire set is tied. More Mastisol is painted over the strips to guarantee that the set is secure (Figure 3a). Regular replacement of new elastics guarantees the effectiveness of the appliance by maintaining the tension. Parents are instructed to leave the appliance in place 24 hours a day, removing it only for cleaning purposes (Figure 3b).

Weekly adjustment visits

Weekly adjustments are required for maximum effectiveness of the presurgical appliance. On each visit, a new impression is taken and poured with plaster of paris. The alveolar cleft is measured with a gauge and approximated by 1 mm. This is done to examine cleft closure and guide adjustment to the appliance. Adjustments are made to the appliance by removing the hard acrylic in the area of growth and adding Coe Soft (GC America, Alsip, Ill) to provide pressure for resorption, thus directing growth in a positive manner. The labial flange and the palate adjacent to the cleft are areas of adjustments. Sporadic emergency appointments are also needed to resolve any ulceration which may develop.

Nasal stent

When closure achieves approximately 5 mm, a nasal stent is fabricated (Figure 4a). It consists of an orthodontic wire bent enough to raise a small Triad "ball" to mirror the adjacent nostril's shape. The nasal stent is attached to the vestibular shield of the appliance, and the tip is pointed toward the medial wall of the defective nostril (Figure 4b). Care must be taken not to obstruct the airway passage. The nasal stent is adjusted with orthodontic pliers to adapt the top portion of the stent to the medial wall of the alar on

Figure 5. A patient photographed following surgery.

the cleft side. The nasal stent is also adjusted once a week to direct cartilage growth by raising the orthodontic wire.

Surgery

The patient will be ready for the primary surgical repair of the nose and lip as soon as the alveolar gap distance reaches a gap of 2 mm or less.

Discussion

The treatment goal for a cleft lip and palate patient is to restore normal anatomy of lip, nose, and palate. Presurgical orthopedic appliances provide alignment of the displaced segments, which present plastic surgeons with an improved facial bone structure on which to carry out gingivoperiosteoplasty, primary lip repair, and primary rhinoplasty.[7] The nasoalveolar molding appliance is a modern presurgical orthopedic device that allows for a positive growth of the alveolar ridges into an improved arch form as well as reshaping of the flattened nose into a more symmetrical shape. As a result of the presurgical appliance, the nose and lip are allowed to heal under minimal tension, thereby reducing scar formation and improving the esthetic result (Figure 5).

It is imperative that parents become active members of the treatment team. If the appliance is lost or not worn, a cleft gap that had been closed early during molding therapy may widen again as the infant places his or her tongue into the cleft. Compliance is an essential factor with this method of treatment. This technique is a growth-centered method for shaping the lip, nose, and alveolus. To date, there is no evidence that the use of the appliance has any negative impact on facial growth and development. However, long-term studies will need to be performed that analyze the overall risks and benefits of this technique.

This paper outlines a method for creating the nasoalveolar molding device. It is the hope of the authors that other centers will use this information to explore the benefits of this technique and then report on their experience with the device. As multidisciplinary, team-centered care is becoming the norm for the treatment of cleft lip and palate, the role of the pediatric dentist and orthodontist in the early treatment of these patients is evolving. This technique demonstrates how cooperation between the cleft surgeon and dental professionals can have a very positive impact early in the life of these children.

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