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Case report

Presurgical nasoalveolar molding: an advantageous adjunctive neonatal therapy for cleft lip and palate defects in 2 clinical cases

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Abstract

The most common congenital craniofacial anomalies are labial-alveolo-palatal clefts. Infants with these deformities may have problems and limitations with breathing, feeding, speaking, hearing, as well as psychological problems.

The treatment protocol for these patients is carried out using an interdisciplinary approach.

Thus, in addition to surgical reconstruction, presurgical neonatal orthopedics have shown considerable advantages in the treatment of such malformations.

Recently, presurgical nasoalveolar molding (PNAM) has been introduced to prevent nasal deformities, and to obtain a satisfactory surgical result and good psychological reintegration.

This article describes, through 2 clinical cases, the technique of preparation of PNAMs, their surgical and clinical advantages, as well as the role of a multidisciplinary approach in effectively managing disorders related to labio-alveolo-palatal clefts.

Keywords

Presurgical nasolabial conformers, maxillofacial prosthodontics, presurgical orthopedics, unilateral cleft lip and palate, slot width, multidisciplinary approach.

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Introduction

Clefts of the lip and palate (CLP) are the most common congenital craniofacial anomalies, with an incidence of approximately 1 person in 500-700 [1, 2]. These deformities represent a real challenge for maxillofacial surgeons and prosthodontists. Individuals born with these malformations require a sequential, multidisciplinary and lifelong approach.

Recently, pre-surgical infant orthopedics (PSIO) have been indicated in order to achieve better clinical results. The term PSIO covers any presurgical neonatal treatment of nasolabial deformities associated with CLP in infants [3]. The term PSIO was originally proposed by McNeil and Burston, and the concept was improved by other researchers [4-6].

Grayson and Cutting have proposed the combination of presurgical orthopedics with nasal molding (presurgical nasoalveolar molding, PNAM) [7]. According to them, a PNAM device helps in the surgical closure of the slit, decreases the width of the base of the nose, and helps to bring the labial edges closer together [8]. The authors have suggested that this device improves nasal symmetry, reduces the need for secondary nasal surgeries, and limits jaw growth disturbances [9]. This article reports two cases of CLP, treated with a PNAM device, and discusses the benefits of this presurgical therapy.

Therapeutic protocol for nasolabial conformers

This is the protocol followed by the maxillofacial prosthodontics team at the dental consultation and treatment center in Rabat, Morocco.

Consultation and clinical examination

A careful clinical examination should be performed by the prosthodontist, in collaboration with the multidisciplinary team.

A complete consultation should take place in order to explain to the parents of the infant with CLP the treatment protocol, the advantages of this therapy, and the need to undertake weekly control visits.

During the first visit, preoperative photographs are taken; these photos include images of the face and oblique submental views of the face for future evaluations.

Diagnosis and treatment planning

The practitioner makes a diagnosis and the treatment plan is thoroughly explained to the baby's family.

The maxillary impression

A maxillary impression is taken to fabricate a working cast. The infant is held upright in the mother's arms while the dentist stabilizes the head for the insertion of the impression material (**Fig. 1**).

Figure 1. The maxillary impression.

After removal of the impression, an oral examination should be performed to ensure that no material has come off.

The maxillary impression is cast with dental plaster and allowed to harden completely. This impression is prepared for use in the construction of an intraoral palatal plate.

The palatal plate

A palatal device is made using an acrylic resin (**Fig. 2**).

The plaster model is covered with a release varnish to prevent acrylic resin from sticking to the plaster.

The palatal plate should be sufficient to support the nasal device.

Figure 2. The intraoral palatal device.

The nasal impression

A nasal impression is made with silicone-type elastomers.

Manufacture of the nasolabial device

After checking the fit of the plate in the mouth, a folded metal wire is embedded into the palatal device and emerged through its labial buccal fringe, this wire ends with a nasal bulb made of self-curing resin, intended to model the cartilage and the nasal dome (**Fig. 3**).

The wire size must be sufficient to allow the nostril edge to be raised. For this, each light bleaching of the nose is a sign of active pressure at this level.

Figure 3. The nasal stent associated to the palatal device.

Insertion of the nasolabial device

After insertion, the device is checked to ensure that it does not include any sharp edges that could injure the baby.

Parents are advised to keep the nasolabial shaper in place at all times, to be removed for cleaning only.

Regular follow-up appointments are scheduled.

Subsequently, post-operative photographs are taken immediately after the PNAM treatment, and after the cheiloplasty, in order to assess the effectiveness of the treatment.

Case reports

2 case studies of CLP, treated by PNAMs, are presented.

Case 1

A 1-month-old baby with CLP was sent to our center for clinical evaluation and the creation of a presurgical device to be able to feed. On clinical examination, a complete unilateral cleft lip and palate (UCLP) was noted. A large space between the edges of the lips, and a deviation of the nose to the unslit side were also noted (**Fig. 4**).

An impression of the maxillary arch was made, using silicone-type elastomers (**Fig. 5**).

Figure 4. Case 1. Upper facial top view of unilateral cleft lip and palate (UCLP) infant.

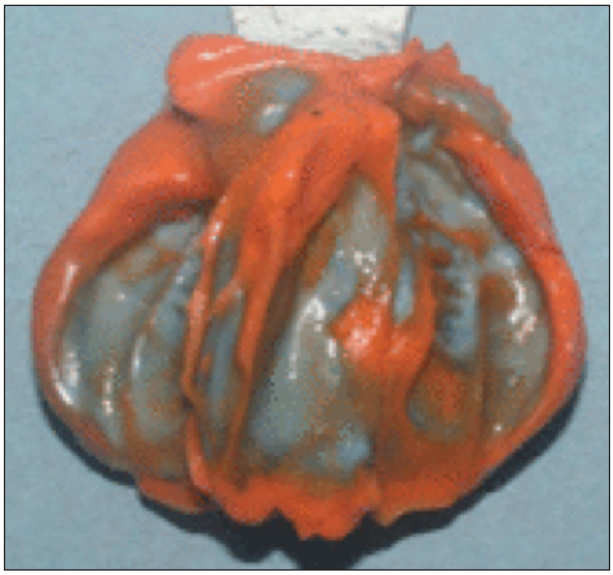

Figure 5. Case 1. The elastomeric impression of the maxillary arch.

The palatal feeding plate was fabricated and inserted first.

After 2 weeks, the nasolabial shaper was incorporated. The device was fitted in the mouth and adjusted accordingly for comfort. Adjustment of the device continued every week to obtain the expected benefits (**Fig. 6** and **Fig. 7**).

During treatment, a reduction in the size of the cleft was observed (**Fig. 8** and **Fig. 9**).

Figure 6. Case 1. The passive palate associated to pre-surgical orthopedics with nasal molding (PNAM) appliance.

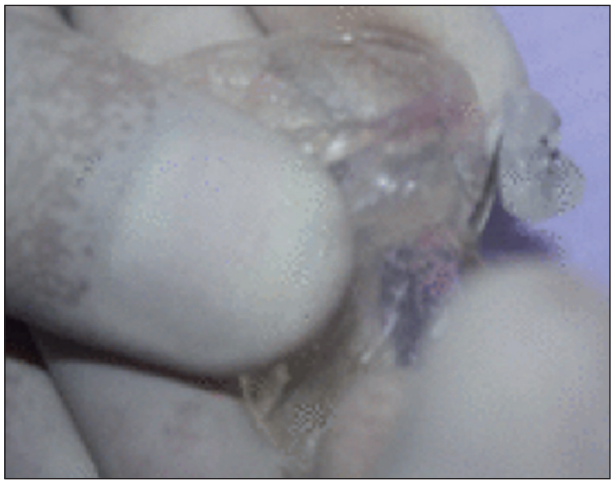

Figure 7. Case 1. Presurgical orthopedics with nasal molding (PNAM) control and adjustment.

Figure 8. Case 1. The evolution of the cleft size during the treatment (first update).

Figure 9. Case 1. The evolution of the cleft size during the treatment (second update).

The postoperative results show increased lengthening of the columella, and a considerable reduction in the asymmetry of the nasal alar cartilage (**Fig. 10**).

Figure 10. Case 1. Post-presurgical orthopedics with nasal molding (PNAM) extra-oral view, following primary surgery.

Case 2

A 3-week-old baby with UCLP was referred to our center for prosthetic care allowing him to improve his diet and breathing. On clinical examination, we noted a complete unilateral cleft lip, associated with columella deficiency and nasal depression (**Fig. 11**)

An impression of the maxillary arch was recorded using silicone-type elastomers (**Fig. 12**).

After 1 and 3 months, respectively, of PNAM treatment, we observed an improvement in nasal symmetry, projection of the tip of the nose, and

Figure 11. Case 2. Unilateral cleft lip and palate (UCLP) pretreatment extra-oral view.

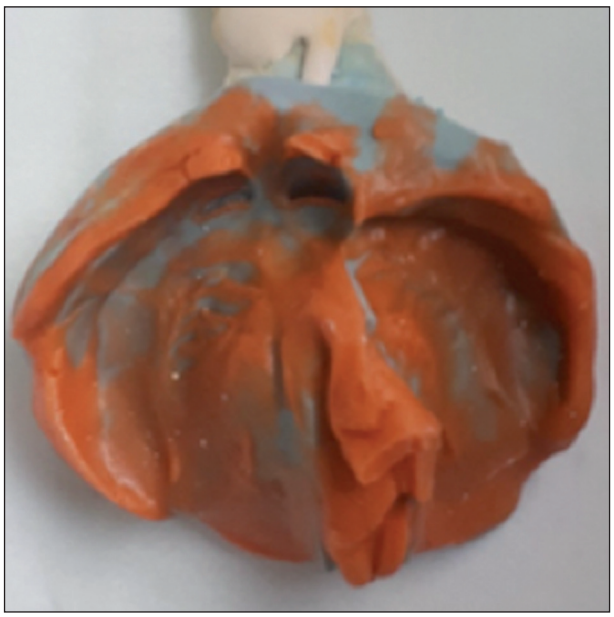

Figure 12. Case 2. The elastomeric impression of the maxillary arch.

an approximation of the edges of the lip segments (**Fig. 13** and **Fig. 14**).

After fitting the PNAM device, certain instructions should be presented to the infant's parents, such as the need to ensure daily cleaning of the device, the importance of wearing the PNAM device while sleeping, and the need for weekly checks, to obtain satisfactory results.

Figure 13. Case 2. 1 month following presurgical nasoalveolar molding (PNAM) treatment.

Figure 14. Case 2. 2 months following presurgical nasoalveolar molding (PNAM) treatment.

Discussion

The use of PNAMs in presurgical orthopedics is an effective therapy for treating CLP defects. In this technique, nasal shaping is facilitated by the high plasticity maintained in the cartilage of infants during the first 3-4 months of life. This plasticity is attributed to hyaluronic acid triggered by maternal estrogen, which circulates in infant cartilage during the first few weeks of birth [10, 11].

To take the impression of the maxillary arch during PNAM treatment, it is preferable to use a heavy impression material. One of the advantages of this material is that it does not tear as easily as alginate [12].

Numerous studies have evaluated the benefits of using PNAM in the treatment of infants with CLP. Kinouchi et al. conducted a retrospective study to assess the efficacity of treatment with PNAM in 29 children with UCLP and with nasal deformities [13]. The study included 13 infants treated with palatal devices associated to nasolabial conformers (the PNAM group), and 16 treated with palatal devices without nasolabial conformers and surgical strips (the control group). The authors concluded that the PNAM group showed significant improvement in nasal asymmetry and columellar displacement. They also found a significant decrease in the interalveolar space, and in the extent of the sagittal cleft. They therefore confirmed that the use of PNAM is an essential therapy during presurgical neonatal orthopedic treatment. However, the authors suggested adding the nasolabial shaper to the palatal plate after reducing the width of the interalveolar cleft to more than 6 mm, otherwise, this therapy may lead to unfavorable results.

To study the effect of long-term PNAMs on the growth of the maxillary arch during infancy, Shetty et al. conducted a randomized clinical trial including children with complete UCLP, who underwent treatment with PNAM at different ages during the first year (1 month, between 1 and 6 months and 12 months of age); the age cut-off for participants was 6 years [8]. The study showed a significant reduction in intersegment distance (ISD) related to the PNAM group, compared to the control group. The authors concluded that a reduction in ISD after treatment with PNAM improves the symmetry and the stability of the

arch, and therefore may prevent the collapse of the palate in the long term. In the same context, Barillas et al. showed that nasal cartilage was more symmetric in infants treated with PNAM than in those treated with surgery alone and this improvement was evident at 9 years of age [14].

Recently, Titiz and Gözlüklü described a new approach to PNAMs in patients with UCLP and severe cleft width [15]. They proposed modified nasal retainers made of flexible acrylic resin. The device has 2 wings and an air channel in each nasal bulb. The authors suggested that this technique was effective and comfortable.

For better treatment results, Shanbhag et al. and Shen et al. suggested the application of three-dimensional technologies (intraoral scanners, digital computer-assisted software, and computer-assisted machining, facilitated by milling machines) to produce PNAMs [10, 16]. They have shown that the use of digitally designed molds is an appropriate and feasible technique because they accurately reproduce the anatomical structures of facial slits. As a result, this technique allows a significant decrease in the number of clinical visits and device adjustments, which may improve the effectiveness of this treatment and lessen the burden on medical staff, patients, and families.

Regarding bilateral cleft lip and palate (BCLP), some studies have shown that PNAMs have significant advantages in presurgical neonatal treatment. Teichgraeber et al. reported a significant reduction in maxillary protrusion and deviation, as well as a decrease in slit width [17]. Indeed, they noted a significant increase in the bi-wing width and an improvement in columellar deviation, associated to an increase in the height of the nostrils both sides. In the same context, Grill et al. reported that PNAMs elongate the length of the columella, and increase the height of the nostrils [18]. However, despite these presurgical and aesthetic outcomes in treating BCLP, the authors concluded that nasal dimensions will not reach healthy proportions.

To obtain satisfactory results in the treatment of children with CLP, it is necessary to adopt a multidisciplinary approach, involving many stakeholders from the medical profession, who cooperate by providing the specialized knowledge and skills necessary to ensure satisfactory comprehensive care [19].

In summary, PNAMs have been shown to represent favorable results for the presurgical neonatal treatment of clefts. However, this technique can be exhausting for the child's family, as it requires repeated clinical visits, and rigorous commitment. Indeed, it can be a time-consuming therapy for some parents.

Conclusion

PNAM treatment is an effective technique allowing a modeling and an approximation of the edges of the maxillary slits, a correction of the asymmetry of the nasal cartilage and increased lengthening of the columella. It also minimizes the need for repetitive secondary interventions. In addition, it improves the psychological attitude of parents, as they visibly see the positive development of the deformities before and after treatment with PNAM.

Informed consent

Informed consent was obtained from the parents of the children who participated in this study.

Declaration of interest

The Authors declare no conflict of interest.

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