

PRESURGICAL NASOALVEOLAR MOULDING FOR AN INFANT WITH UNILATERAL CLEFT LIP AND PALATE : A CASE REPORT.

Dr. Arkajit Goswami*, Dr. Partha Pratim Choudhury**
 Dr. Hussain Lokhandwala***, Dr. Amal Kumar Chakraborti****
 Dr. Rup Kumar Das*****, Dr. Bhupender Kaur*

ABSTRACT

Presurgical infant orthopaedics has been employed since 1950 as an adjunctive neonatal therapy for the correction of cleft lip and palate. The presurgical nasolaveolar molding (PNAM) technique reduces the severity of the initial cleft and nasal deformity before lip surgery. This enables the surgeon to repair a cleft deformity that is minimal in severity. Long term studies on PNAM therapy showed better lip and nose form, reduced oronasal fistula and labial deformities, 60 % reduction in the need for secondary alveolar bone grafting. This article describes a case report where a 28 days old infant having unilateral cleft lip and palate is treated with PNAM procedure that produced considerable reduction in size of cleft allowing successful surgical lip closure.

KEY WORDS

Presurgical nasolaveolar moulding, PNAM, Unilateral cleft lip and palate, moulding plate, infant orthopedics

ABOUT THE AUTHORS

*Final year PGT, **Assistant Professor
 Consultant Orthodontist, *Professor & PG Guide
 *****Professor, PG Guide & Head
 Dept. of Orthodontics, Dr. R. Ahmed Dental College & Hospital, Kolkata, West Bengal

CORRESPONDING AUTHOR

Dr. Partha Pratim Choudhury
 Assistant Professor
 Dept. of Orthodontics, Dr. R. Ahmed Dental College & Hospital, Kolkata, West Bengal

INTRODUCTION

Cleft lip and palate (CLP) is a congenital anomaly resulting from embryological defects during formation of the face. They have quite wide and complex etiology, affecting around 1 in 700 live births throughout the world.¹ The nose, lips, and maxillary arch of the baby suffering from the disease are often severely malformed. The alar cartilage on the cleft side, which is flattened or concave and pushed out by the alveolar gap, results in depression, and displacement of the nasal tip towards the side of the cleft. Furthermore, the nasal septum and the columella are inclined with the base deviated to the noncleft side.² Treatment of CLP ideally requires a multidisciplinary team but the standard treatment protocol still remains debatable.^{3,4} There are two main approaches, one involving surgical repair alone and the other involving presurgical moulding of the cleft segments followed by surgical repair.⁴ McNeil first introduced the concept of modern presurgical orthopedics in 1950⁵. The basis of presurgical nasolaveolar molding (PNAM) treatment is Matsuo's research that says high level of estrogen during parturition causes increased levels of hyaluronic acid in baby's body, inhibiting the linkage of the intercellular cartilage matrix and thus permitting the moulding of the facial cartilages. The level of estrogen starts declining within 4 months after birth; therefore, birth to 4 months is the ideal time to commence presurgical orthopedics.⁶

The first presurgical nasolaveolar moulding (PNAM) appliance was described by Grayson et al in 1999⁷ and is a widely accepted approach.¹ The appliance consists of an intraoral moulding plate with nasal stents to mould the alveolar ridge and nasal cartilage simultaneously.⁸ The treatment goals are to reduce the width of the cleft gap with reduction in soft tissue and cartilaginous deformity, to align and approximate the intraoral alveolar segments, and to allow a surgical repair with minimal tension.¹ The nasolaveolar moulding technique has been shown to significantly improve the surgical outcome of the primary surgical repair compared to other techniques of presurgical orthopaedics.⁸

The present case report describes the treatment of an infant with unilateral CLP by the PNAM appliance.



Fig. 1. Pretreatment photos

MATERIALS AND METHODS

A 28 days old female child reported to the Department of Orthodontics and Dentofacial Orthopedics of Dr. R. Ahmed Dental College and Hospital with an UCLP of the left side. Her medical and family histories were not significant. On clinical examination, complete cleft lip and cleft palate of the left side was observed and classified as Veau's Class III type cleft [Figure 1]. PNAM followed by primary surgical repair was planned and executed.

TREATMENT OBJECTIVES

The treatment objectives were to appose bilateral lip tissues, to reduce the width of the cleft and to normalize the alveolar arch form, to correct the nasal deformities, and finally to allow a surgical repair with minimal tension.

TREATMENT ALTERNATIVES

The following alternatives were there⁹

- Dynamic presurgical nasal remodeling intraoral appliance.
- OrthoAligner “NAM” & NAM custom aligners.
- Dynacleft and nasal elevators.
- Cheiloplasty without PNAM

TREATMENT PROCEDURE

Impression technique :

After obtaining an informed consent from the parents, and explaining the risks and benefits of PNAM, the case was scheduled for an impression. Following the Grayson's technique^{7,8} a pretrimmed custom made tray without any sharp edges was prepared according to the approximate size of the

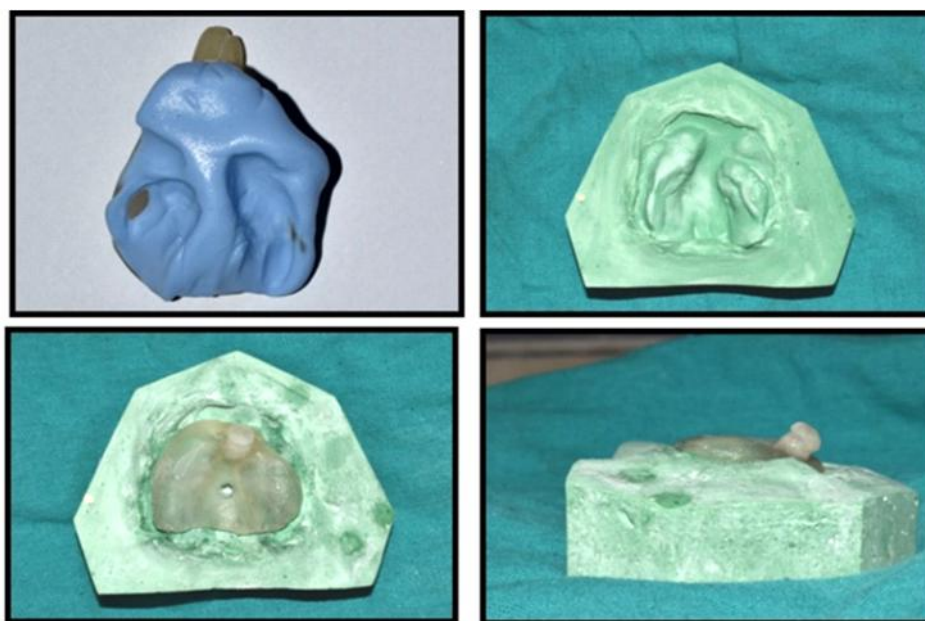


Fig 2. Pretreatment model and moulding plate



Fig. 3 NAM appliance and nasal hook in place

maxillary arch, based on an initial wax impression. The impression was taken with a heavy-bodied silicone impression material (Figure 2). The infant was held in a retroclined position to prevent any airway blockage either by the tongue fall back or by accumulation of oral fluids⁷. The impression material should adequately cover the upper gum pads. Once the impression material was set, the tray was removed, and the mouth was examined for any remaining impression material. The impression was then poured with dental stone to obtain an accurate cast. Measurements made with calipers showed 7.5mm of labial cleft and 10 mm of alveolar cleft was present.

Appliance fabrication and design:

After blocking all the undercuts and applying separating media to the prepared cast, cold cure acrylic resin was used with Sprinkle-on technique to fabricate the moulding appliance (Figure 2).

The plate was 2-3 mm thick and lined by soft denture liners to prevent tissue irritation. The borders in the place of the frenum and other attachments were relieved. A retention button was placed anteriorly at an angle of 40° to the plate for securing the plate with elastics. The retention button should not interfere with closure of cleft lips and was placed at the junction of the upper and lower lip. A small opening of 6-8 mm in diameter was made on the palatal surface of the moulding plate to provide an airway if accidentally the plate drops down posteriorly. The construction of nasal stent was delayed until the cleft of the alveolus is reduced to about 5-6 mm in width.

Appliance insertion and taping

The appliance was then secured extraorally to the cheeks bilaterally by elastic tapes (Dynaplast -3/4th inch wide and 3-4 inch long) that have orthodontic elastic bands at one end (Figure 3). A skin barrier tape like Micropore (3M) on the cheeks was used to reduce irritation on the cheeks. The elastics (inner diameter

0.25 inch, wall thickness heavy) were stretched approximately two times their resting diameter for proper activation force of about 100 grams⁸. Parents were instructed to keep the plate in the mouth all time and only to remove it for daily cleaning. Tapes were changed 2-4 times a day to generate constant orthopedic force.

Appliance adjustments

The baby was seen weekly to make adjustments to the moulding plate to bring the alveolar segments together. These adjustments were made by selectively removing the acrylic corresponding to inner aspect of greater alveolar segment and adding the soft denture base material to the outer aspect. No more than 1 mm of modification of the moulding plate was made at one visit.

Incorporation of the nasal hook

Interaction force between nasal stent and intraoral molding plate would reduce the efficiency and accuracy of the whole device^{1,10}. To eliminate the above interaction force, separate nasal hooks (MU hooks) 10 were used. Independent action of the nasal hook can improve nasal tip projection and better decrease the nasal alar base width. The force was adjusted such that the nose tip just turned white, if not, the force should be increased. Tape connecting the nasal hook and the forehead was changed daily.

RESULTS

By the above mentioned procedure, the shape of the alveolus and nose were gradually moulded to resemble their normal anatomy. Pre and post treatment extraoral photographs revealed an reduction in the size of the cleft. By the end of PNAM treatment, the cleft lip gap was reduced to 1.5mm from pre-treatment value of 7.5mm (Fig.4). The improvement was evident with the two parts of lips nearly contacting each other.



Fig. 4. Post PNAM photos

Primary surgical repair of the alveolus, lip and Nose

Surgical closure of the lip and nose was performed at 4 months of age. Primary surgical repair of the cleft lip with Millard's rotational advancement flap technique was performed.

DISCUSSION

After Grayson et al introduced the PNAM concept in the 1990s, it continues to play a significant role in neonatal CLP treatment. There have been a number of reports on effectiveness of PNAM in patients with ULCP²(Grayson et al. 1999, Grayson and Cutting 2001, Yang et al. 2003 etc.). In ULCP, like the present case, the use of the presurgical appliance provide a more coalescent cleft and an ideally shaped alveolar arch form. This in turn reduces tension during the primary surgery, thereby reducing scar formation. This alignment of the alveolar segments lays the foundation for good lip symmetry that produces more favorable bone formation by reducing the cleft gap. In addition, retrospective studies by Santiago et al.¹¹ shows that a significant decrease in alveolar cleft size results in a diminished need for bone grafting during the mixed dentition stage. In addition to the lip and alveolus, most cleft surgeons today recommend correction of cleft lip nasal deformity at the time of primary lip repair.

Long term effects of PNAM can also be seen in the form of improvement in occlusion, feeding, speech, hearing, language development and aesthetics^{9, 12-13}.

Apart from this Grayson and Maull¹⁴ and Cutting and colleague¹⁵ evaluated the financial impact of 2 treatment approaches to the unilateral cleft alveolus. They compared NAM, and gingivoperiosteoplasty at the time of lip repair with the traditional approach of lip repair followed by secondary alveolar bone graft. Of the 16 patients treated by NAM and primary nasal repair, 10 required no further treatment of the unilateral cleft alveolus; 6 patients required



Fig.5. Post Surgery Photos

secondary alveolar bone graft. Thus making PNAM procedure more cost effective¹⁶.

Certain concerns regarding PNAM exist like unibody nasal stent instability, parental cooperation 1, vomiting, ulceration, and non-compliance¹⁷. Proper parental counselling and separate nasal hook as described above will solve the initial problems. Levy-Bercowski et al.¹⁸ offered some further preventive measures to reduce complications e.g. specific techniques in taking the impression, limiting the posterior limit and minimizing the thickness of the occlusal plate (2 to 3 mm).

Personalization of the surgeon also needs to be considered¹. Different surgeons have different surgical preferences. A number of surgeons prefer a total closure of the gap before cheiloplasty while some others want certain gap to be present to facilitate a vomer flap operation.

CONCLUSIONS

PNAM is a relatively easy and passive method of bringing the alveolus and lips together by redirecting the forces of natural growth. It also allows for correction of the flattened nose prior to surgery and facilitates nose repair at the primary lip repair stage.

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