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### RESEARCH ARTICLE

## NASO ALVEOLAR MOLDING BY TRADITIONAL GRAYSON'S TECHNIQUE AND A MODIFIED TECHNIQUE INVOLVING REDUCED PATIENT VISITS-TWO CASE REPORTS

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### Abstract

Cleft lip and palate are congenital deformities affecting approximately 1 in 500–700 births. Their management requires a multidisciplinary team, including paediatricians, paediatric dentists, orthodontists, craniofacial and plastic surgeons, and speech therapists. Presurgical nasoalveolar moulding (PNAM), typically initiated by a paediatric dentist, uses an oral moulding plate with a nasal stent to reduce the alveolar cleft gap, reshape the nasal cartilage and alveolus, improve nasal alignment before primary lip closure, support feeding, and reduce nasal regurgitation. This report describes two infants with complete unilateral cleft lip and palate treated using either the traditional Grayson technique or a modified technique advocated by the Nitte Meenakshi Institute of Craniofacial Surgery, Nitte University. After three months, both techniques reduced the alveolar cleft gap, decreased the width of the affected nasal dome, and increased its height, producing a more normal nostril contour. The modified technique reduced the need for weekly hospital or cleft-centre visits; follow-up every two to three weeks was sufficient. PNAM is therefore an important component of cleft care because it reduces deformity and postoperative scarring, may limit the need for later scar-revision surgery, and facilitates gingivoperiosteoplasty by approximating the alveolar segments. Larger longitudinal studies are needed to determine whether the Nitte modification is superior because it reduces follow-up visits and chairside time.

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**Introduction:-**

Cleft lip and/or palate (CL/P) is one of the most prevalent congenital craniofacial birth abnormalities in the head-and-neck regions. The World Health Organization (WHO) estimates that one in 500–700 people are born with this condition, and that number varies greatly between geographic locations. The nasal deformities associated with unilateral cleft lip and palate is: deviation of the nasal septum towards the non-cleft side, depressed, flattened nasal dome on the cleft side due to disruption of the lower lateral alar cartilage, widened, flared, and inferiorly displaced alar base on the cleft side, short columella displaced towards the non-cleft side, reduced nostril height / vertical dimension on the cleft side.

Nasal deformity becomes more distorted with the time if no surgical mediation is undertaken.[1]. Secondary surgical revision of the nasal deformity would lead to more surgical interventions and more scarring and less than ideal results [2]. Thus, any form of the nonsurgical treatment to reduce the nasal deformity early in the life is highly desirable. There have been attempts in the experimental animal models to reverse this deformation by in utero nasal moulding [3]. The increased plasticity of the immature infant cartilage is due to a raised circulating maternal oestrogen leading to elevated levels of hyaluronic acid which renders the cartilage soft, pliable and more mouldable due to its plasticity. It is best utilized within the first 6 weeks of the birth [5]. First attempt at the presurgical nasal correction was made by Matsuo et al. [5, 6]. Grayson [7] conceptualized the combination of the presurgical nasal moulding with the conventional form of the presurgical orthopaedics.

The primary goal of PNAM is to reduce soft-tissue and cartilaginous cleft deformities, thereby minimizing scar formation and creating favourable conditions for surgical correction of the soft-tissue defect. PNAM helps guide growth, allowing improved repositioning of the alveolar segments and nasal structures. It also supports feeding, enhances facial aesthetics, and may provide psychological benefits.

Despite its effectiveness, the traditional Grayson technique requires weekly adjustments and follow-up visits to the cleft centre for approximately 3–4 months. For families living far from the treatment centre, this schedule can create considerable financial and practical difficulties. Caregivers may need to travel long distances and lose a day's wages each week, which is especially challenging for those employed as daily-wage workers in the unorganised sector. This concern was frequently reported by parents attending our cleft centre at a tertiary hospital in West Bengal. To reduce this burden, we adopted the modification described by Ajay Bajaj et al. [8], which permits appliance adjustments at intervals of two to three weeks while still achieving the intended correction. This case report describes two infants treated with the traditional and modified approaches and compares their outcomes using clinical photographs of the nasolabial region and dental casts.

**CASE REPORT 1:** A 1-month-15-day-old male infant presented to the Department of Pedodontics with cleft lip and palate. The child was born at term by caesarean delivery, with a birth weight of 3 kg. There was no history of consanguineous marriage, oro-facial clefts in the family, or maternal illness during pregnancy. Clinical examination revealed a right-sided cleft lip extending into the alveolus, hard palate, and soft palate, consistent with Veau group III cleft lip and palate (Figures 1.1 and 1.2). Presurgical nasoalveolar moulding was planned as part of the initial treatment, with the aim of reducing the cleft gap and improving tissue approximation before surgical repair.



**Figure 1.1:** Cleft involving right side of the lip extending to alveolus hard and soft palate



**Figure 1.2:** Cleft involving right side of the upper lip



**Figure 1.3: pre- operative cast**



**Figure 1.4: oral plate delivered**



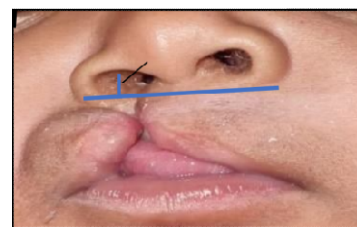
**Figure 1.5 (a): oral plate with nasal stent**



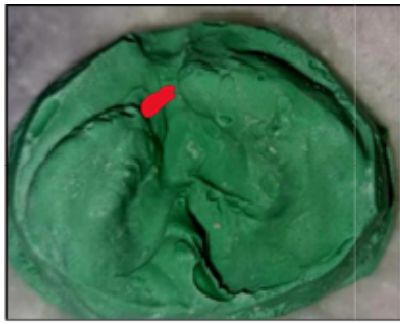
**Figure 1.5(b): Nasoalveolar moulding**



**Figure 1.6: Pre operative nasal height**



**Figure 1.7: Post operative nasal height**



**Figure 1.8: preoperative alveolar cleft gap**



**Figure1.9: Post operative cleft gap**



**Figure 1.10: post surgical image**

At the first appointment, initial lip taping was done using a 3M micropore tape and dynoplast. A one-fourth inch width of dynoplast is taken, the taping done from the unaffected side to affected side with a pressure just enough to approximate the two parts of the lip which are separate due to cleft. A primary impression was made with modelling wax, followed by preparation of the primary cast and fabrication of a custom tray. At the second the labial aspect of the greater alveolar segment. 1-mm relief was created by trimming the acrylic on the labial aspect of the lesser alveolar segment and the palatal aspect of the greater alveolar segment. This was intended to promote alveolar moulding through bone resorption in the areas covered by the soft liner and bone deposition in the relieved areas. For retention, an acrylic handle measuring 15 mm in length was fabricated, with its terminal end shaped appointment, a secondary impression was made using an elastomeric impression material, addition silicone. The master cast was then prepared. It was used to fabricate the oral moulding plate A soft liner was added to the palatal aspect of the lesser alveolar segment and into a bulb to engage the elastics.

The oral plate was delivered with lip taping in place (Figure 1.3). the patient was recalled every week for selective addition of soft relining resin and removal of acrylic to result in negative sculpting by the addition of soft reliner resin to a thickness of 2mm on the buccal aspect of the greater segment and trimming of a layer 2mm of acrylic from the palatal aspect of the greater segment and vice-versa for the lesser segment. After one month, the cleft gap had decreased from 10 mm to 5 mm. at this stages a nasal stent was fabricated from a 21-gauge stainless-steel wire in a swan-neck configuration. An acrylic bulb was added to the stent and covered with a soft liner to prevent mucosal irritation [Figure 1.5(a) & 1.5(b)]. The stent elevated the depressed nasal ala on the cleft side and helped mould and reshape the nasal ala and nostril. One month after stent placement, marked elevation of the nasal ala and improved nostril form were observed (Figures 1. 6 and 1.7). After two months of treatment with the NAM plate and nasal stent, a follow-up impression was made for comparison. The cleft gap had reduced from 10mm to 3.5mm. [ Figure 1.8 and 1.9]. The negative sculpting produced labial movement of the lesser segment, palatal movement of the greater segment, and the gum pads assumed a more favourable arch form. Improved nutrition was reflected by an increase in body weight from 3 kg to 6 kg. The patient was then referred to the medical hospital for primary lip repair, and the postoperative result is shown in Figure 1.10.

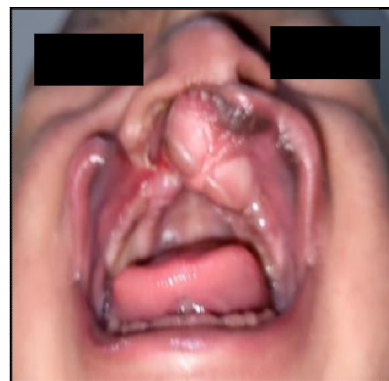
**Case Report 2:-**

A 15-day-old female neonate with unilateral cleft involving the right side, visited the hospital presented to our department with a facial cleft. She was born at term by vaginal delivery and weighed 2.5 kg at birth. There was no family history of cleft lip or palate, maternal alcohol use, smoking, or significant medical illness. Clinical examination revealed a right-sided cleft lip and Cleft palate with deformity of the right nasal ala (Figures 2.1 and 2.2). Lip taping was initiated at the first appointment (Figure 2.3). A wax impression was made, followed by fabrication of a custom tray. The final impression was recorded using heavy-body addition silicone. During the procedure, the infant was held prone in the mother's lap with the neck extended to provide adequate access and visibility. The head was carefully supported, and the posterior extent of the tray was directly visualized. The impression material was controlled to prevent overflow beyond the tray borders.

The infant was monitored throughout the procedure and kept actively crying, which helped maintain airway patency and allowed direct visualization of the cleft. All undercuts and the cleft space were blocked out with plasticine, giving the cast the appearance of an intact alveolus. Layers of plasticine was also added as a spacer in the region where the major segment was expected to move palatally during treatment (Figure 2.4 and Fig 2.4a). Blocking out the cleft space and adding the spacer formed the crucial modification, eliminating the need for weekly trimming of the appliance as required in Grayson's protocol. The borders of the plate were carefully smoothed, and adequate relief was provided around the labial frenum attachments. The retention arm measured 15 mm in length and 5 mm in diameter and was angulated at 30° to the occlusal. A soft liner of 2mm thickness was added to the labial aspect of the greater alveolar segment. A nasal stent was fabricated from 21-gauge round stainless-steel wire as an extension from the labial flange of the NAM plate. Its free end extended into the nostril to support the deformed nasal cartilage. The NAM plate with the nasal stent was subsequently delivered (Figure 2.5). Unlike Grayson's technique nasal stent was incorporated with the oral plate at the onset of appliance therapy and we did not wait for cleft gap to reduce by 5mm to add nasal stent. This will utilize the early elasticity of the appliance. After two adjustments wherein the greater segment was modified by adding soft relining resin to the buccal aspect of the greater segment at an interval of three weeks, there was a reduction in cleft gap from 12 mm to 5 mm (Figure 2.6 and figure 2.7) and the child was referred for primary lip repair. We can also notice that the deviation of the nasal tip and nasal aperture height has improved in Figure 2.8 and 2.9. the body weight of the patient improved from 2.5 kg to 6.0 kg in three months. The postoperative result after primary lip surgery is shown in Figure 2.12.



**Fig2.1: deformity of right nasal ala**



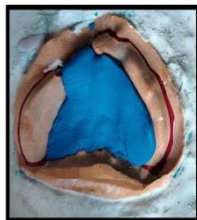
**Fig 2.2: deformity of the alveolus and palate**



**Figure 2.3: Impression by condensation silicone**



**Fig 2.4 (a): the modified NAM plate as advocated by Dr. Ajay Bajaj et al**



**Figure 2.4: the blocked out cast**



**Figure 2.5: the appliance delivered**



Figure 2.6: the alveolar cleft gap of 11mm



Figure 2.7: alveolar cleft gap reduced to 5mm

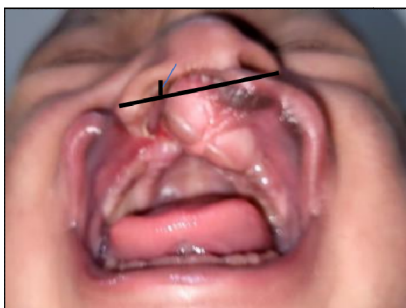


Figure 2.8:

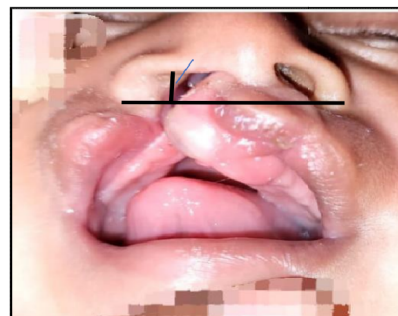


Figure 2.9



Figure 2.10

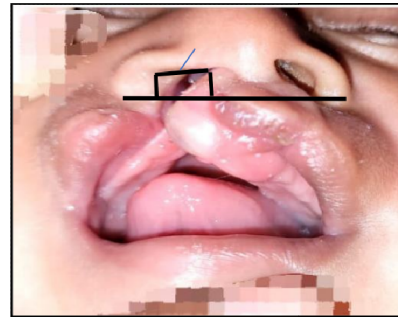


Figure 2.11

**FIGURE 2.8 to 2.11- shows the pre-operative and post operative changes before and after changes of PNAM. Figure 2.8, 2.9 shows the nasal height- pre-operative (vertical black line), shows the nasal height- post-operative (vertical black line) respectively. Figure 2.10, 2.11 shows the nasal base has become more horizontal with respect to intercanthal line and the deviation of columella has improved**



Figure 2.12: post operative result

### Discussion:-

Since its introduction in the 1950s, the use of presurgical orthopedics in cleft lip and palate cases has generated controversy. But critics of the presurgical therapy have characterized it as an expensive, time-consuming, and unnecessary process.[6] When treating cleft lip and palate deformities, the nasoalveolar molding technique offers a number of advantages. NAM therapy greatly reduces the amount of the cleft deformity prior to surgery, which makes primary repair of the lip, alveolus, and nose simple. [7] Long -term studies of NAM therapy point out that the changes in the nasal shape is stable with less scar tissue and better lip and nasal form.[8].This eliminates the number of surgical revisions for nasal and labial deformities and excessive scar tissue.[9]. With the alveolus in a more favourable alignment there are chances of better periodontal and alveolar bone support for the erupting permanent teeth[ 10]. Studies have also indicated that most of the patients who were treated with NAM therapy and the surgical lingivoperiosteoplasty procedure did not require secondary bone grafting. [11]. Reduced number of surgeries leads to greater cost savings for families and also results in lesser surgical morbidity. [12].The conventional Grayson's technique of PNAM involved usage of Nasal stent only after the alveolar cleft gap reduced to 0.5 cm or less. On the other hand, Figueroa technique involved adding nasal stent to the intra oral molding plate on the first appointment itself. The rationale behind this was to use the plasticity of the nasal cartilage as early as possible.. Koya et al, [13] made some further alterations from the original design which included addition of U loop to the nasal stent which helped in retention of plate as well as adjustment of the stent.

The innovation done by Bajaj et al in which spacer was applied on the palatal side of the greater segment was adopted in the second case. This made the treatment less laborious as it avoided the selective trimming of the molding plate at every appointment and also the patient did not need to visit to the cleft centre after every week.

Like Figueroa, they have recommended adding the nasal stent with the first oral plate when the alveolar cleft gap is lesser or equal to 12mm. To reiterate, the advantage is an appointment after every three weeks might be sufficient.[6]

The association of feeding problems in cleft patients has been widely documented. Wilcox et al. [14] demonstrated the link between malnutrition and mortality in underdeveloped nations. Pandya and Boorman [15] reported that infants in wealthy nations with cleft palates did not flourish. The Craniofacial/Lactation Infant Feeding (CLIF) clinic addressed the feeding problems of the patients and formed a feeding team consisting of a nutritionist, a feeding specialist (either occupational or speech therapy), and a lactation counselor.[16] Pan-Yun Chou et al[17] did a rare study of using 3D images to determine the progression of PNAM treatment in patients of unilateral cleft lip and palate.

In the reported cases, the mean cleft lip gap was about 11mm before treatment, which dropped to 4.5 mm at the end of treatment. The duration in both the case was about three months. PNAM, however, can cause some complications. The most frequent ones are intraoral tissue ulcers and inflammation of the gingival or oral mucosa. The child needs to be examined at every appointment, and any regions where the molding plate is applying too much pressure need to be appropriately relieved. The plate can drop down and block the airway. A 6-8 mm diameter hole should be drilled to prevent airway blockage. [7] The Indian sub-continent remains one of the most populous areas of the world with an estimated population of 1.1 billion in India alone. This yields an estimated 24.5 million births per year and the birth prevalence of clefts is somewhere between 27,000 and 33,000 clefts per year. Inequalities exist, both in access to and quality of cleft care with distinct differences in urban versus rural access and over the years the accumulation of unrepaired clefts of the lip and palate make this a significant health care problem in India. In recent years the situation has been significantly improved through the intervention of Non-Governmental Organisations such as SmileTrain and Transforming Faces Worldwide participating in primary surgical repair programmes.[18]

### **Conclusion:-**

Pre surgical naso-alveolar molding is a first and crucial step in multidisciplinary management of the cleft lip, alveolus and palate, in case report 1, we used conventional grayson's technique and case report 2 we opted for modified technique advocated by Ajay Bajaj et al from the Nitte Craniofacial Institute for molding the alveolus, reducing the cleft space, elevation of nasal ala. Both techniques have shown a significant molding of alveolus, nose, reduced the cleft space which facilitated a more aesthetic result after the primary lip surgery. However, case 2 required less follow up visits and lesser chair side time. A longitudinal study with greater sample size must be conducted to evaluate the relative comparison of the two techniques.

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