Benefits and challenges of presurgical nasoalveolar molding placement for a unilateral cleft lip and palate a case series

Manfaat dan tantangan pemasangan *presurgical nasoalveolar molding* pada celah bibir lelangit unilateral serangkaian kasus

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ABSTRACT
Pre-surgical nasoalveolar moulding (PNAM) has been applied to reshape the divided nasal structure, facilitate surgical intervention, and reduce the severity and tension of the cleft. This article presents three cases of patients with unilateral cleft lip and palate (UCLP) who underwent PNAM prior to surgery, highlighting the diverse cases of cleft and patient characteristics, which aid in the management of nasal clefts and yield more robust evidence-based outcomes. The main challenge in PNAM therapy is ensuring patient and family caregiver compliance with treatment, given that young patients must adapt to the device fitting and activation. Monitoring also requires regular and repeated visits, which can be time-consuming and cause psychological stress due to witnessing the patient's adaptation to the device. It is concluded that PNAM treatment reduces the width of the alveolar cleft. This treatment improves nasal symmetry by altering the columella angle, maintaining alar width, extending the height of the nostrils on the affected side, and increasing columella length. Cooperation between patients, family caregivers, and the medical team is essential for better outcomes.
Keywords: presurgical nasoalveolar moulding, unilateral cleft lip and palate, nasal splint, extraoral retention button, nutrition

ABSTRAK
Pre-surgical nasoalveolar molding (PNAM) telah diterapkan untuk membentuk ulang struktur hidung yang terbelah, memudahkan intervensi bedah, dan mengurangi keparahan serta tegangan pada celah. Artikel ini memaparkan tiga kasus penderita celah bibir dan lelangit unilateral (UCLP) yang menjalani PNAM sebelum operasi, yang beragam kasus celah dan karakteristik pasien, yang membantu dalam pengelolaan celah hidung dan hasilnya berbasis bukti yang lebih kuat. Tantangan utama dalam terapi PNAM adalah memastikan kepatuhan pasien dan pengasuh keluarga terhadap pengobatan, mengingat pasien muda harus beradaptasi dengan pemasangan dan aktivasi perangkat. Pengawasan juga memerlukan kunjungan rutin dan berulang yang dapat memakan waktu dan menimbulkan tekanan psikologis akibat menyaksikan adaptasi pasien terhadap pemasangan. Disimpulkan bahwa perawatan PNAM mengurangi lebar celah alveolar. Perawatan ini meningkatkan simetri hidung dengan mengubah sudut kolumela, mempertahankan lebar alar, memperpanjang tinggi lubang hidung pada sisi yang terkena, dan meningkatkan panjang kolumela. Kerjasama antara pasien, pengasuh keluarga, dan tim medis sangat penting untuk hasil yang lebih baik.
Kata kunci: *presurgical nasoalveolar molding*, celah bibir lelangit unilateral, penyangga hidung, tombol retensi ekstraoral, gizi
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INTRODUCTION

Unilateral cleft lip and palate (UCLP) are common congenital craniofacial abnormalities often linked with dentoalveolar issues such as midfacial hypoplasia, structural deformities, segmental displacement, and nasal tissue deficiency.[1] A global epidemiological study by Salari et al. estimated the prevalence of cleft lip and palate (CLP) to be 0.45 per 1,000 live births.[2] In Indonesia, national health survey data indicated a rise in prevalence from 0.08% in 2013 to 0.12% in 2018.[3] This condition places a significant psychosocial and economic burden on affected families and substantially impacts patients' quality of life. Children with CLP often experience challenges in speech, hearing, feeding, and psychosocial development.[4]

In *unilateral cleft lip and palate* (UCLP), the nasal structures display considerable deformity because to the outward rotation of the premaxilla on the affected side. This causes flattening and inferior displacement of the nasal tip. The deviation of the nasal septum deflects the columella and shifts the nasal base to the unaffected side. The lower deformed alar cartilage is depressed and rotated inferiorly. Pre-surgical nasoalveolar molding (PNAM) was created by Grayson and Cutting in 1998 is a non-surgical procedure performed early after birth in CLP patients to normalize the upper lip, alveolus, and nostrils by using a palate device attached to a nasal stent. In simple words when the defect has been reduced to a smaller size it would become simpler to operate and would result in less scar tissue and contracture.[5-7]

The PNAM therapy is suitable for tongue position, encourages in proper pronunciation, enhances esthetic and psychosocial parameters with refined feeding and skeletal curvature.[9] With some limitations, Matsuo used a tubular silicone stent to shape the nostril. These include the need to shape the base of the nose (simoartband or liposome adhesion) and the inability to direct force as the stent extends circumferentially. Grayson et al made a nasal stent for anterior wing expansion of an intraoral molding plate.[10]

The biggest advantage of the NAM is practitioners can easily use it to apply force to shape the nasal cartilage, as the stent is part of the molding plate, instead of unformed nasal base. It involves the correction of nose morphology and approximation of lip and alveolar segments. Though from a clinician's perspective, all corrections achieved through PNAM therapy are equally important, from parental perspective lip correction is appreciated most as treatment progresses and can act as a motivation in appliance wear in further period.[10]

CASE

Department of Prosthodontics at Hasanuddin Univer-

sity Dental Hospital in 2023 to 2024 received three neonatal patients with UCLP for PNAM therapy. These patients were initially referred by the Oral and Maxillofacial Surgery Department prior to undergoing surgical intervention. The first case involved a 7-day-old male infant weighing 2.6 kg. The second was a 20-day-old female infant, weighing 2.7 kg, who lived on an island outside the city of Makassar. The third patient was a male infant, 28-days-old, with a birth weight of 3.0 kg. All three patients were born to non-consanguineous parents, and none had a known family history of cleft lip or palate on either the maternal or paternal side. Additionally, no hereditary disorders were identified in any of the cases. Each patient had an unremarkable perinatal history, without systemic complications or prior medical treatments. Clinical intraoral examination revealed a complete cleft involving the premaxillary alveolus, soft palate, and hard palate on the left side. Based on Veau's classification, all cases were identified as Class III clefts. Notably, extraoral assessment of the third infant demonstrated a collapsed left nasal rim and a nasal septum deviated to the right. (Fig.1).

Figure 1 Pasients with UCLP

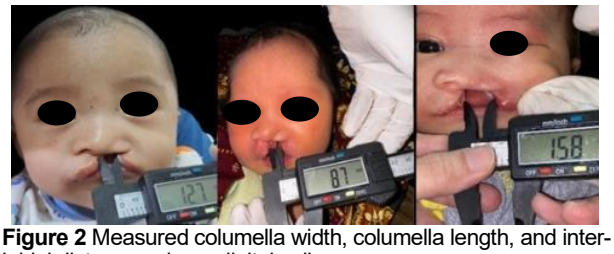

Figure 2 Measured columella width, columella length, and interlabial distance using a digital caliper

MANAGEMENT

At the first visit, clinicians performed baseline measurements to monitor changes during PNAM therapy. They measured columella width, columella length, and interlabial distance using a digital caliper (Fig.2). They took a maxillary impression with a custom tray and irreversible hydrocolloid, ensuring proper infant positioning, operators control, and even material flow for accuracy and safety (Fig.3). After obtaining the working cast, they began fabricating the PNAM appliance. They designed a 2-3 mm thick acrylic baseplate, lined it with soft denture material to protect mucosa, and relieved areas around the frenulum and other attachments. Modeling wax blocked undercuts to ensure a smooth internal surface. They added a spacer and processed a 3 mm thick prosthesis using heat-cured acrylic for durability and future alveolar trimming. They created a groove at the base of the nasal stent sleeve for elastic attachment. At the next visit, they trial-fitted the appliance and trimmed areas that caused tissue blanching to improve comfort and fit (Fig.4).[11]

In the second visit, the plate is implanted, and the entire intraoral area is assessed; if found appropriate, lip taping may begin. Tape is placed at the base of the nose (nasolabial angle) and not under the lip near the vermillion margin. Tape that is too low may cause an undesirable horizontal extension of the lip. Tape should be placed on the non-gap side and then pulled over the gap side, the philtrum and columella should be at midline. Lip taping provides several advantages of lip adhesion to surgery without surgical morbidity, cost, and scarring (Fig. 5).[11] For lip taping, we use Hypafix which is pulled larger than sinistra and use a special skin base tape that is applied to the cheek to avoid irritation (DuoDERM®CFG®)

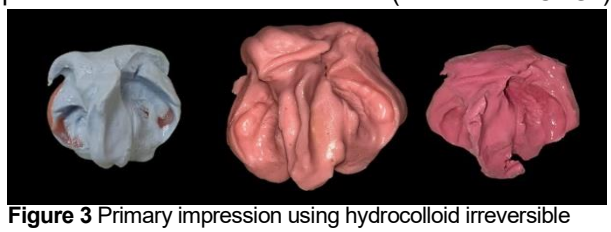

Figure 3 Primary impression using hydrocolloid irreversible

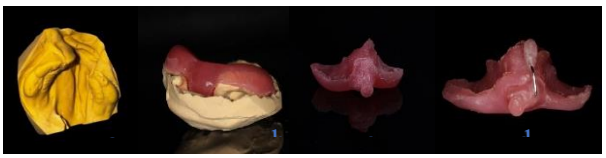

Figure 4a Model study, **b** feeding plate, **c** feeding plate with button, **d** insertion nasal stent

The PNAM device features an extraoral adjustment button strategically positioned to guide targeted anatomical correction. Clinicians secure bilateral surgical tape with orthodontic elastics, carefully directing traction at a precise 45-degree upward angle to apply controlled forces to the affected tissues. After thorough explanation of the procedure, caregivers were asked to demonstrate proper appliance placement to ensure correct technique. Following delivery of the appliance, our protocol scheduled a mandatory follow-up visit within 24 hours. This early evaluation served multiple purposes: assessing the infant's adaptation to the device, verifying proper use by parents, and addressing any immediate concerns about appliance management. Parents received detailed instructions emphasizing the importance of continuous wear, with removal permitted only for cleaning. We recommended daily maintenance using a soft brush and lukewarm water, along with a structured replacement schedule: surgical tapes every 2-3 days and daily renewal of the elastic traction system to maintain optimal force direction throughout treatment.

During the third visit, the clinical team evaluates the infant's ability to breastfeed directly and monitors weight gain to ensure the child reaches the optimal weight for surgery. A pediatrician assesses the infant's overall health to confirm they are fit for continued treatment. Parents are asked about their compliance with the appliance pro-tocol and must demonstrate how they insert and remove the plate to ensure proper technique. Inside the mouth, the team checks for any

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signs of irritation caused by ex-cessive pressure from the device. If the plate has shifted

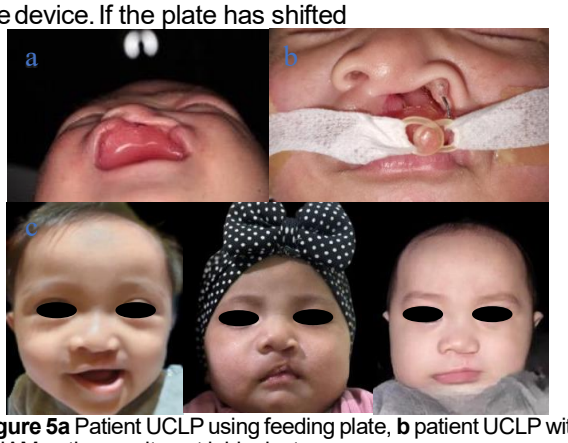

Figure 5a Patient UCLP using feeding plate, **b** patient UCLP with PNAM, **c** the result post labioplasty

or caused uneven movement, it is carefully adjusted trimmed and smoothed to guide the larger alveolar segments toward the smaller ones. Once the gap between the alveolar segments narrows to 5 mm or less, a nasal stent is introduced. This stent, made from a 0.7 mm orthodontic wire bent into a gentle swan-neck curve, is secured inside the nostril with a small loop. The upper part of the stent lifts the nasal tip, while the lower part supports the columella, enhancing nostril symmetry.

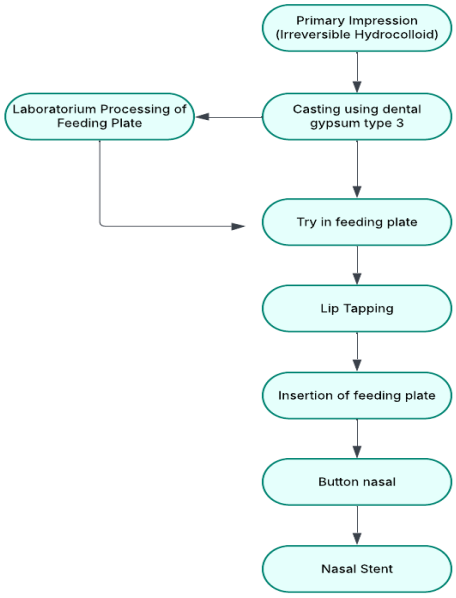

Chart 1 Treatment process for UCLP patients

DISCUSSION

The objectives of PNAM for UCLP patients include realigning the divided maxillary alveolar segments to their proper position, narrowing the cleft gap, and adjusting the positioning of the nasal cartilages, columella, and philtrum. Additionally, it aims to center the columella along the midsagittal plane, lengthen the columella, improve nostril symmetry, and reduce scarring after cheiloplasty. PNAM works by molding the alveolar segments, bringing them closer together, thereby reducing tension on the lip both before and during cheiloplasty. Combining nasal molding with alveolar molding enhances both aesthetic and functional outcomes.[13]

In patients with UCLP undergoing PNAM, nutrition plays a crucial role in optimizing therapeutic outcomes. Unlike other cleft patients, the UCLP often face unique nutritional challenges due to difficulties in feeding and swallowing, particularly in infants and young children with both a CLP. Proper nutritional management during the presurgical phase can significantly enhance the healing process of soft tissues, thereby supporting more effective outcomes from PNAM, which aims to shape and mold the tissue around the cleft.[14] These patients require a high-calorie, high-protein diet to facilitate tissue repair and promote optimal growth, which is vital for successful prosthetic intervention. Adequate nutrition also helps prevent dehydration and malnutrition, which can hinder the efficacy of PNAM and delay the proper formation of soft tissues, compromising the prosthetic treatment outcome. In contrast, UCLP patients who do not undergo PNAM may not have as specialized dietary needs at the presurgical stage, as they are typically directly prepared for surgical procedures without the preceding prosthetic molding phase.[15]

A key distinction in nutritional needs for UCLP patients undergoing PNAM is the increased requirement for micronutrients, particularly vitamin A and vitamin C, which are essential for wound healing and enhancing skin elasticity, vital for the success of PNAM therapy. Additionally, there is a heightened need for anti-inflammatory and immune-modulating nutrients to support the body during the soft tissue shaping process with the molding appliance. Nutritional supplements containing vitamin D and calcium are also recommended to support bone development and ensure stable tissue growth, which will be crucial for the success of later surgical interventions. Therefore, nutrition for UCLP patients undergoing PNAM requires a comprehensive and carefully monitored approach to avoid deficiencies that could compromise both the prosthetic therapy and post-surgical recovery.[16] This interdisciplinary management of nutrition and prosthethic care is essential for achieving optimal long-term results in cleft lip and palate treatment. Preoperative malnutri-

Table 1 Review of literature published case reports of UCLP with PNAM

Author	Intial impression material	Lip tapping material	Intersegment distance		Year of Publication
			preoperative	postoperative	
Kumar A, Mogre S	Hydrocolloid Irreversible	Steri-Strips adhesive tape	11 mm	6 mm	2018
Goswami A, Choudhury PP, Lokhandwala H, Chakraborti AK, Das RK, Kaur B	Heavy-bodied silicone	Dynaplast	7,5 mm	6 mm	2021
Ferreira AN, da Costa GC	Compound	Velcro strip modified	8,3 mm	5,3 mm	2022
Mathew JA, Kamble RH, Pallavi Daigavane PS, Pandey R	Putty	Hypavix	15 mm	5 mm	2023

Jaiswal A, Galhotra V, Angel SL, Gandham R	Putty	Steri-Strips adhesive tape	9 mm	5 mm	2024

tion poses significant risks to surgical safety and postoperative recovery. Providing skilled feeding support to mothers of infants with clefts is essential to prevent inadequate nutrition and optimize conditions for timely, safe surgical intervention.[17] Evidence suggests that suboptimal nutritional status correlates with increased surgical complications.[18] Surgical procedures elevate metabolic demands as the body repairs trauma; thus, sufficient nutritional intake is critical to facilitate proper wound healing.[19] Studies indicate that CLP children exhibit higher rates of underweight status compared to non-cleft peers. Advocates of PNAM highlight its long-term advantages, including improved nasal symmetry, superior lip aesthetics, and enhanced facial balance.[13]

Emerging evidence from randomized controlled trials suggests that lip taping alone may achieve comparable cleft reduction effects to active PNAM, underscoring the critical importance of nasal molding components. This technique proves particularly effective in bilateral cleft cases, where it helps realign the displaced nasal tip while adjacent tissues assist in repositioning the severely deviated premaxilla. Contemporary approaches have successfully incorporated spring-loaded devices and external acrylic stents for nasal molding.[20] However, PNAM implementation faces several challenges including poor adherence, gastric intolerance, mucosal irritation, caregiver compliance issues, and mechanical instability of integrated nasal stents. Initial compliance barriers may be addressed through comprehensive parent education and the use of discrete nasal retention hooks. Levy-Bercowski et al. proposed several preventive strategies to mitigate complications, including modified impression techniques, posterior border control, and maintaining appliance thickness at 2-3mm.[21]

Caregivers received specific instructions to maintain continuous appliance wear, with removal permitted only for daily sterilization procedures. The device facilitates both breastfeeding by enhancing suckling efficiency and nasal respiration through obturation of the cleft defect. Selective application of tissue conditioner to the alveolar segments enabled directional force application-inward on the greater segment and outward on the lesser segment-thereby promoting alveolar tissue approximation.[22] Precise alveolar repositioning was achieved through synergistic effects of the intraoral appliance and external lip taping.[23] The initial adaptation period typically requires approximately seven days for patient acclimatization. Consistent follow-up visits are crucial for appliance activation and to monitor treatment progress, though efficacy may be compromised when caregivers demonstrate poor adherence to clinical recommendations.

It is concluded that PNAM is particularly beneficial in reducing cleft width and correcting misaligned nasal cartilages, columella, and filtrum in patients with UCLP. The nose can be constructed higher with the use of nasal stents. This may have less of an impact, though, if the patient's parents or other family caregivers are not cooperative.

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