applied sciences

MDPI

Article

Changes in Alveolar Cleft Width and Nasal Measurements During Presurgical Nasoalveolar Molding in Vietnamese Infants with Unilateral Cleft Lip and Palate: A Retrospective Pre-Post Study

Huyen Thanh Nguyen [1], Trang Thi Thu Vu [2], Linh Thuy Nguyen [1,*], Jean Marc Retrouvey [3], Thanh Duc Le [4] and Tuan Khang Nguyen [5]

[1] Department of Orthodontics, National Hospital of Odonto-Stomatology Hanoi, Hanoi 10000, Vietnam; huyenortho@gmail.com
[2] Department of Orthodontics, Hanoi Medical University, Hanoi 10000, Vietnam; vuthutrang@hmu.edu.vn
[3] Department of Orthodontics, University of Missouri-Kansas, Kansas, MO 64110, USA; jeanmarcretrouvey@gmail.com
[4] Department of Oral and Maxillofacial Surgery, National Hospital of Odonto-Stomatology Hanoi, Hanoi 10000, Vietnam; dr.lethanh1982@gmail.com
[5] Department of Oral and Maxillofacial Surgery, McGill University, Montreal, QC H3A 0G4, Canada; tuan.k.nguyen@mail.mcgill.ca
* Correspondence: linhnguyen253@gmail.com

Abstract

Introduction: Cleft lip and palate (CLP) is among the most common congenital craniofacial anomalies, with significant functional and aesthetic implications. Presurgical nasoalveolar molding (NAM) has been introduced as an early intervention to improve alveolar alignment and nasal symmetry prior to surgical repair. **Objective:** This study aimed to assess changes in alveolar cleft width, nostril height and width ratios, and columellar angle between NAM initiation and the presurgical assessment in Vietnamese infants with unilateral cleft lip and palate. **Methods:** A retrospective pre-post observational study analyzed 32 infants with UCLP who had complete paired data among 193 infants treated with NAM between January 2013 and August 2023. NAM therapy was initiated within the first month of life. Cleft width was measured on dental casts, and nasal symmetry was assessed using standardized photographs and indirect anthropometric measurements (nostril height ratio, nostril width ratio, and columellar angle). Paired-samples *t*-tests were used for statistical analysis ($p < 0.05$). **Results:** The study showed a significant increase in the nostril height ratio ($p < 0.001$), a decrease in the nostril width ratio ($p < 0.001$), a reduction in cleft width ($p < 0.001$), and an increase in the columellar angle ($p < 0.001$) after NAM treatment. **Conclusions:** Changes in alveolar cleft width and photographic nasal measurements were observed during presurgical NAM in this cohort. The increase in nostril height ratio was compatible with the protocol's intended overcorrection, but did not establish improved height symmetry. The uncontrolled design limits attribution of these changes to NAM.

Keywords: nasoalveolar molding; unilateral cleft lip and palate; alveolar cleft width; orthopedic treatment

Check for updates

Academic Editor: Iole Vozza

Received: 19 September 2026
Revised: 15 November 2026
Accepted: 18 November 2026
Published: 24 November 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.

1. Introduction

Cleft lip and palate (CLP) constitutes one of the most prevalent congenital craniofacial anomalies worldwide [1]. A systematic review reported birth prevalences of orofacial clefts

of 1.57 per 1000 live births in Asia, 1.56 in North America, 1.55 in Europe, 1.33 in Oceania, 0.99 in South America, and 0.57 in Africa [2]. In Vietnam, the prevalence is estimated to range between 1 and 2‰ [3]. Among the different phenotypic presentations, unilateral cleft lip and palate is the most frequently observed form of congenital facial cleft [4].

CLP exerts a significant impact on multiple aspects of patient health, including facial aesthetics, feeding efficiency, speech development, auditory function, and dentition [5]. These complex impairments necessitate coordinated, multidisciplinary management extending from infancy through adulthood [6]. The concept of presurgical orthopedic intervention was first introduced by McNeil in 1950 [7] and subsequently refined by researchers including Hotz and Gnoinski (1979) [8] and Latham et al. (1976) [9], marking a pivotal advancement in the early treatment of CLP.

Historically, most presurgical orthopedic techniques have solely focused on alveolar segment alignment [10,11]. Matsuo et al. (1989) described early nonsurgical correction of cleft-related nasal deformities, drawing on neonatal cartilage malleability; they did not introduce the combined NAM protocol [12]. Building on this principle, Grayson et al. introduced NAM in the 1990s as a comprehensive presurgical approach aimed at molding the alveolus, lip, and nose to optimize surgical outcomes [13]. The NAM protocol involves gradual approximation of alveolar segments through selective addition of soft liner and removal of hard acrylic on an intraoral plate, while a nasal stent elevates and reshapes the depressed nasal cartilage. Additionally, adhesive lip tapes are applied to exert horizontal and vertical traction, facilitating lip segment approximation. NAM is commonly initiated in early infancy to take advantage of neonatal cartilage malleability, although the optimal timing and long-term effectiveness remain uncertain [14].

This study aimed to assess changes in alveolar cleft width, nostril height and width ratios, and columellar angle between NAM initiation and the presurgical assessment in Vietnamese infants with unilateral cleft lip and palate.

2. Materials and Methods

2.1. Study Design

This retrospective pre-post observational study used existing clinical records. Eligible participants were infants younger than one month at the initiation of NAM appliance therapy and presenting with unilateral cleft lip and palate who underwent treatment between January 2013 and August 2023. Exclusion criteria comprised additional craniofacial anomalies, cardiovascular disorders, and insufficient records for paired T0–T1 analysis. Documented caregiver non-adherence, loss to follow-up related to geographical distance, and elective surgery at other institutions were recorded as distinct reasons for incomplete follow-up. Of 193 infants who received NAM during the study period, 32 had complete paired data and met the remaining eligibility criteria; the other 161 were not included in the analysis because complete paired records were unavailable.

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Science and Ethics Committee of the National Hospital of Odonto-Stomatology in Hanoi (Decision No. 1323/QD-BVRHMTWHN, dated 30 December 2022). Written informed consent was obtained from the legal guardians of participating infants. Clinical data were anonymized and handled confidentially for research purposes.

2.2. Study Procedure

Prior to treatment, standardized extra-oral photographs were obtained for baseline documentation. Before impression-taking, patients were required to fast for at least 120 min to minimize aspiration risk. Intraoral procedures, including impression taking, relining, and appliance insertion, were performed under the supervision of an anesthesiologist, with

full emergency equipment available, including oxygen delivery systems. Vital signs were continuously monitored before, during, and after the procedures to ensure patient safety. Initially, an impression was taken using silicone material for customized tray fabrication, followed by a final impression using the customized tray and silicone material (Elite HD+, Zhermack, Italy) (Figure S1). The impressions were poured with dental stone to make cast models. The undercuts in the cleft area of the cast models were filled with wax to create continuity of the palate and alveolar bone. A custom clear self-curing acrylic plate was made on the model. After confirming the acrylic plate, the appliance was fabricated by adding three elements: nasal lift component (10–12 mm in length), connecting stainless steel wire (0.8 mm diameter), and retention component (0.9 mm diameter). A helix loop was incorporated into the connecting stainless steel wire to facilitate nasal adjustment and improve control of direct force application to the nostril (Figure S2). The relining procedure was then performed intraorally using a soft silicone material to ensure optimal adaptation of the appliance to the patient's oral structures. Immediately after relining, the soft silicone material in the cleft area was carefully trimmed, allowing for cleft closure when wearing the appliance (Figure S3). The NAM device was then inserted and secured to the infant's mouth (Figure S4). Caregivers received comprehensive instructions regarding appliance maintenance and usage.

All appliances were fabricated by one orthodontist with 4 years of experience in cleft care. At each weekly visit, the soft liner was selectively added to the plate and trimmed at the pad adjacent to the cleft to direct alveolar segment movement. The nasal stent was adjusted by bending the helix loop 1–2 mm in the vertical direction per visit to lift the nasal dome and lengthen the columella. Adhesive lip taping was applied from the first visit using 3M tape, changed after each feeding by caregivers. Caregivers were instructed to ensure that the infant wore the appliance throughout the day and to clean it after each feeding. Compliance was assessed using a checklist-based questionnaire completed by caregivers. Documented non-adherence referred to caregiver-reported refusal or discontinuation of the prescribed appliance wear. Follow-up loss due to geographical barriers and decisions to undergo surgery at another institution were classified separately rather than being treated as evidence of non-adherence. Primary lip repair was scheduled using the Millard technique when the infant reached either 6 kg in body weight or 6 months of age, whichever occurred first.

Follow-up protocol: Weekly visits were scheduled to adjust nasal molding and palatal pressure. The inner portion of the plate was gradually adjusted to facilitate the molding of the palate and alveolar bone. Once the height of the affected nostril exceeded that of the contralateral nostril by approximately 20%, follow-up intervals were extended to monthly assessments until definitive cleft lip repair was performed.

2.3. Data Collection and Data Analysis

Measurements were assessed at two time points: before NAM initiation (T0) and before primary lip repair (T1). Alveolar cleft width was measured on dental casts, and nasal parameters were measured on photographs obtained at these time points. T1 represented the presurgical assessment, rather than the time at which the target overcorrection of nostril height was reached. Alveolar cleft width was defined as the linear distance between the opposing medial alveolar crest points of the greater and lesser alveolar segments on the dental cast (Figure 1). The anatomical landmarks were identified visually, and the distance between them was measured in millimeters using a precision caliper.

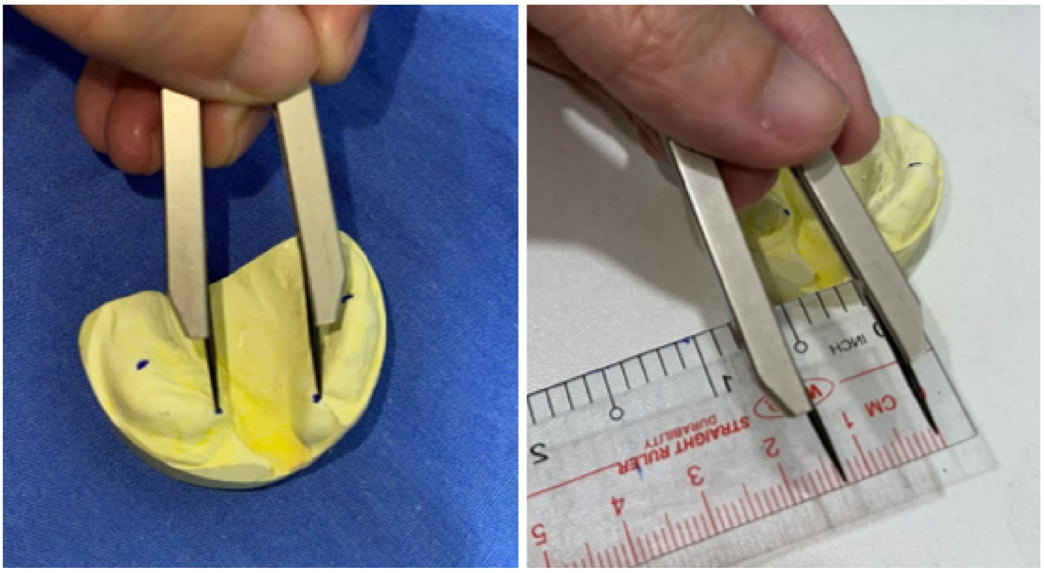


Figure 1. Measurement of cleft width.

Standardized photographic documentation was performed in accordance with the European Association of Craniofacial Surgery guidelines [15]. All images were captured using a Nikon D7500 camera equipped with a Nikon AF-S DX 18–140 mm F/3.5–5.6G ED VR lens. Photographs were taken from a submental oblique view with the jaw tilted upward to provide optimal visualization of nasal and labial structures. The focus was maintained on the nose and upper lip regions to assess the outcomes of NAM therapy.

Indirect anthropometric measurements were conducted on these images using Adobe Photoshop (Photoshop CC 2014) software. Nostril height and width were measured in pixels using Adobe Photoshop. At each time point, cleft-to-non-cleft-side ratios were calculated from measurements obtained on the same photograph using the same image scale. Because the photographs lacked dimensional calibration, absolute pixel measurements were not used to assess changes in nasal dimensions between time points. Nasal symmetry was evaluated based on three parameters:

1. **Nostril height**—measured as the vertical distance from the highest point of the nostril to a reference line connecting the right and left alar bases (Figure 2).
2. **Nostril width**—measured as the horizontal distance between the medial nostril border adjacent to the columella and the lateral nostril border at the alar margin (Figure 2). The same landmarks were applied to the cleft side despite discontinuity of the nostril floor.
3. **Columellar angle**—defined as the acute angle superior to the bilateral alar-base reference line, formed between that line and the columellar axis (Figure 2). An angle of 90° corresponds to a columellar axis perpendicular to the reference line.

These measurements provided objective criteria for assessing nasal morphology and symmetry during NAM therapy.

To minimize the effects of variations in image angulation and magnification, nostril height and width were expressed as ratios of the cleft side to the non-cleft side. A ratio of 1.0 indicated perfect symmetry, whereas deviations from this value reflected asymmetry. Two experienced orthodontists independently measured alveolar cleft width on dental casts and columellar angle on photographs. Interobserver agreement was assessed separately for each outcome at baseline (T0) and before primary lip repair (T1), with 32 paired observer measurements at each time point. Bland–Altman differences were calculated as Observer 1 minus Observer 2 and plotted against the mean of their measurements. Mean bias and 95%

limits of agreement, calculated as the mean difference ± 1.96 standard deviations of the differences, were reported.

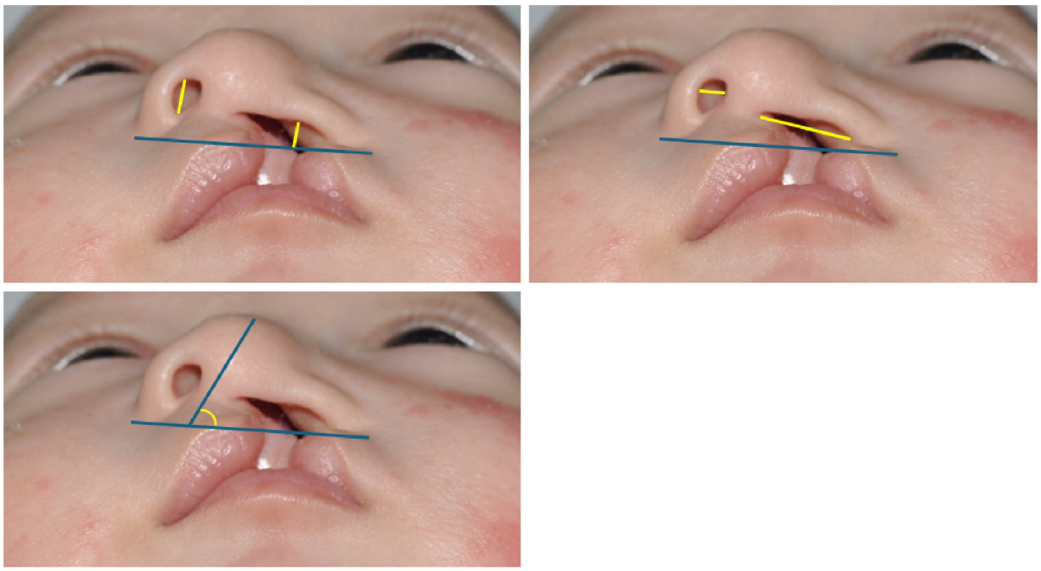


Figure 2. Submental oblique photograph illustrating the measured nostril height (top left), nostril width (top right), and columellar angle (bottom).

Statistical analyses were performed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Differences between pre-treatment and post-treatment variables were analyzed using paired-samples *t*-tests, with the level of statistical significance set at $p < 0.05$.

3. Results

Of 193 infants treated with NAM during the study period, 32 had complete paired records for analysis (161 were not analyzed). The analyzed cohort comprised 22 males (69%) and 10 females (31%). All infants had UCLP, with left-sided involvement in 62.5%. With respect to birth order, 20 patients (62.5%) were first-born, 3 (9.4%) were second-born, and 9 (28.1%) were third-born. The mean age at the initiation of treatment was 17.1 ± 2.1 days, and the mean duration of treatment was 110.3 ± 44.3 days, as summarized in Table 1.

Table 1. Overview of patient demographics.

Demographics	(*n* = 32 Patients)
Sex	
Male	22 (69%)
Female	10 (31%)
Cleft side	
Right side	12 (37.5%)
Left side	20 (62.5%)
Birth order	
First born	20 (62.5%)
Second born	3 (9.4%)
Third born	9 (28.1%)
NAM	
Initial age, days	17.1 ± 2.1
Duration, days	110.3 ± 44.3

Abbreviation: NAM, nasoalveolar molding.

The results demonstrated a statistically significant reduction in cleft width, decreasing from 12.4 ± 2.9 mm pre-treatment to 6.9 ± 2.6 mm post-treatment ($p < 0.001$). In addition, a significant decrease in the nostril width ratio was observed, from 3.02 ± 1.1 to 2.01 ± 0.62 ($p < 0.001$). The mean nostril height ratio increased from 0.90 ± 0.40 before treatment to 1.23 ± 0.38 after treatment ($p < 0.001$). A marked improvement was also noted in the columellar angle, which increased from 47.4 ± 11.1 degrees to 78.9 ± 10.7 degrees following treatment ($p < 0.001$). These findings are presented in detail in Table 2.

Table 2. Alveolar cleft width and nasal measurements before NAM initiation (T0) and before primary lip repair (T1).

Outcome	Before NAM (T0)	Before Lip Repair (T1)	*p*-Value *
Cleft width (mm)	12.4 ± 2.9	6.9 ± 2.6	<0.001
Nostril height ratio	0.9 ± 0.4	1.23 ± 0.38	<0.001
Nostril width ratio	3.02 ± 1.1	2.01 ± 0.62	<0.001
Columellar angle (°)	47.4 ± 11.1	78.9 ± 10.7	<0.001

*: Values are presented as mean ± standard deviation. Cleft width is expressed in millimeters and columellar angle in degrees. Nostril height and width ratios are dimensionless. *p*-values were obtained using paired-samples *t*-tests.

For alveolar cleft width, mean interobserver bias was 0.049 mm at T0, with 95% limits of agreement from −0.333 to 0.430 mm, and −0.019 mm at T1, with limits from −0.317 to 0.279 mm. For columellar angle, mean bias was −0.375° at T0, with limits from −6.467° to 5.717°, and 0.375° at T1, with limits from −5.296° to 6.046°. Mean interobserver biases were close to zero for both outcomes. For columellar angle, the limits of agreement extended to approximately 6° in either direction.

Pain during appliance wear was documented in 2 of the 32 infants (6.3%). Additionally, 9 patients (28.1%) developed skin or mucosal lesions in the cheek area during the course of treatment (Table 3). These complications necessitated appliance modifications and additional caregiver training on proper appliance use and care. When required, anti-inflammatory medications or topical creams were prescribed to facilitate healing, and a temporary interruption of therapy for 1–2 weeks was recommended to allow for adequate recovery.

Table 3. Incidence of treatment-related adverse events.

Adverse Event	Number of Patients Affected (*n*)	Percentage of Patients Affected (%)
Pain	2	6.3
Skin or mucosal injury	9	28.1

4. Discussion

Our study observed a 5.5 mm reduction in cleft width (from 12.4 mm to 6.9 mm) following treatment. This finding aligns with Monasterio et al. (2013) [16], who reported a reduction from 11.2 mm to 5.9 mm in patients treated with the Grayson appliance. The reduction in cleft width occurs as the larger and smaller palate segments, initially separated by the cleft, are guided along a pre-designed palate model, allowing them to gradually converge without obstruction.

The nostril width ratio decreased, and the columellar angle increased after treatment. The mean nostril height ratio increased from 0.90 before NAM to 1.23 after treatment. The post-treatment mean was above 1.0, which is compatible with the protocol's aim of overcorrecting cleft-side nostril height. However, a statistically significant increase in this ratio does

not establish improved height symmetry, because symmetry depends on the proximity of each infant's ratio to 1.0 rather than on the direction of change alone. Individual-level analysis is needed to determine whether height asymmetry decreased. Postoperative symmetry and the persistence of these changes were not assessed. In a prospective Vietnamese study of 95 paired dental casts, Dinh et al. (2022) [6] reported changes in cleft width and nostril dimensions based on three-dimensional measurements. Although some changes were in the same direction as those observed here, angular results are not directly comparable without confirming equivalent measurement conventions. Williams et al. (2012) [17] examined nasal outcomes in a unilateral cleft cohort, whereas Spengler et al. (2006) [18] studied bilateral clefts, making the latter study less directly comparable. Overall, our findings document presurgical changes in this cohort rather than demonstrating that NAM independently produced those changes.

The observed changes may be relevant to presurgical preparation; however, this study did not assess whether they facilitated surgical repair or improved postoperative outcomes. From a practical standpoint, the appliance used in this study, which combines a locally fabricated acrylic plate with a helix-loop nasal stent, may represent an accessible option in settings where prefabricated NAM systems, three-dimensional digital workflows, or specialized cleft centers are limited, as is often the case in Vietnam. In such contexts, the ability to achieve nasal and alveolar improvement with weekly outpatient adjustments, followed by monthly reviews, may also help reduce the burden of frequent travel for families.

The timing of NAM initiation remains a subject of debate. Most authors recommended starting therapy shortly after birth and continuing until primary lip repair [14,19–21]. Grayson and Maull (2004) [22] suggested initiating nasal molding when the cleft lip gap is ≤5 mm to avoid excessive nostril stretching, whereas Figueroa et al. (1993) [23] advocated for simultaneous nasal and alveolar molding immediately after birth. Liao et al. (2012) [24] cautioned against overly early nasal molding, as it may cause nostril enlargement ("mega nostrils").

Skin or mucosal lesions were documented in 9 of 32 infants (28.1%), and pain was documented in 2 (6.3%). These events were managed with appliance adjustments, topical medication when indicated, and caregiver education; a temporary interruption of 1–2 weeks was recommended when clinically necessary. These findings highlight the importance of close clinical monitoring and proper caregiver training to minimize treatment-related complications during NAM therapy.

This study has several limitations that should be acknowledged. Its retrospective design, small analytic sample (32 of 193 treated infants), and incomplete follow-up may limit the generalizability of the findings. Restricting analysis to infants with complete T0–T1 records may introduce substantial selection bias because families who discontinued treatment, could not return because of distance, or pursued surgery elsewhere were underrepresented. The absence of an untreated comparison group prevents separation of NAM-associated changes from natural growth and other concurrent influences. The observed changes therefore cannot be attributed solely to NAM. Nasal measurements were also derived from two-dimensional photographs, which are susceptible to variations in head position and camera angle despite standardization. Interobserver agreement was assessed only for alveolar cleft width and columellar angle; agreement for the nostril height and width ratios was not evaluated. For columellar angle, the limits of agreement extended to approximately 6° in either direction, indicating uncertainty in individual angular measurements despite the small mean bias. Finally, long-term outcomes following surgical repair were not evaluated. Therefore, future studies should address several questions. First, prospective, multicenter designs with a concurrent control group are needed to separate the effect of NAM from natural growth and from surgical technique. Second, the optimal timing of nasal molding should be defined, particularly in relation to the initial cleft width

and the age at initiation. Third, long-term follow-up through childhood and adolescence is needed to determine whether the presurgical nasal changes persist and whether they reduce the need for secondary revision surgery and orthodontic treatment. Fourth, standardized three-dimensional imaging would improve measurement accuracy and comparability between centers, and digital workflows such as intraoral scanning and 3D-printed appliances may reduce the number of visits and improve reproducibility. Finally, cost-effectiveness and caregiver burden should be evaluated in low- and middle-income settings to guide the wider implementation of NAM.

5. Conclusions

In this cohort of infants with UCLP, alveolar cleft width and nostril width ratio decreased, while columellar angle and nostril height ratio increased during presurgical NAM. The post-treatment mean nostril height ratio exceeded 1.0, which is compatible with the protocol's intended overcorrection rather than evidence of improved height symmetry. The absence of a control group limits attribution of the observed changes to NAM. Postoperative outcomes and the persistence of these changes require further evaluation.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/doi/s1, Figure S1: Silicone impression taking using Elite HD+ (Zhermack, Italy); Figure S2: Appliance fabrication in the laboratory; Figure S3: Relining procedure; Figure S4: NAM appliance.

Author Contributions: Conceptualization, H.T.N.; Methodology, H.T.N. and T.K.N.; Software, T.D.L.; Validation, J.M.R.; Formal analysis, T.T.T.V.; Writing—original draft, T.D.L.; Supervision, H.T.N.; Project administration, L.T.N. All authors have read and agreed to the published version of the manuscript.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Ministry of Health Hanoi National Hospital of Odonto-Stomatology Institutional Review Board (protocol code 1323/QĐ-BVRHMTW and date of approval: December 30, 2022).

Informed Consent Statement: Written informed consent has been obtained from the patient(s) to publish this paper.

Data Availability Statement: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Mossey, P.A.; Little, J.; Munger, R.G.; Dixon, M.J.; Shaw, W.C. Cleft lip and palate. *Lancet* **2009**, *374*, 1773–1785. [CrossRef] [PubMed]
2. Panamonta, V.; Pradubwong, S.; Panamonta, M.; Chowchuen, B. Global Birth Prevalence of Orofacial Clefts: A Systematic Review. *J. Med. Assoc. Thai.* **2015**, *98*, S11–S21. [PubMed]
3. Trường, T.V. Tạo hình khe hở môi một bên và hai bên. *Tạp Chí Học Việt Nam* **1999**, *241*, 81–88.
4. Doğan, S.; Önçağ, G.; Akın, Y. Craniofacial development in children with unilateral cleft lip and palate. *Br. J. Oral Maxillofac. Surg.* **2006**, *44*, 28–33. [CrossRef] [PubMed]
5. Salman Aminwala, M.; Jaffar Abbas Zaidi, S.; Ashraf Ganatra, M.; Taqi, M.; Hamid, D.; Aminwala, Z. Evaluating quality of life changes in patients with cleft lip or palate: A mixed method pre- and postsurgical analysis in Karachi. *BMC Oral Health* **2024**, *24*, 1509. [CrossRef] [PubMed]
6. Dinh, T.T.N.; Van Nguyen, D.; Dien, V.H.A.; Dong, T.K. Effectiveness of Presurgical Nasoalveolar Molding Appliance in Infants with Complete Unilateral Cleft Lip and Palate. *Cleft Palate Craniofac. J.* **2022**, *59*, 995–1000. [CrossRef] [PubMed]

7. McNEIL, C.K. Orthodontic procedures in the treatment of congenital cleft palate. *Dent. Rec.* **1950**, *70*, 126–132. [PubMed]
8. Hotz, M.M.; Gnoinski, W.M. Effects of early maxillary orthopaedics in coordination with delayed surgery for cleft lip and palate. *J. Maxillofac. Surg.* **1979**, *7*, 201–210. [CrossRef] [PubMed]
9. Latham, R.A.; Kusy, R.P.; Georgiade, N.G. An extraorally activated expansion appliance for cleft palate infants. *Cleft Palate J.* **1976**, *13*, 253–261. [PubMed]
10. Hotz, M.; Perko, M.; Gnoinski, W. Early orthopaedic stabilization of the praemaxilla in complete bilateral cleft lip and palate in combination with the Celesnik lip repair. *Scand. J. Plast. Reconstr. Surg. Hand Surg.* **1987**, *21*, 45–51. [CrossRef] [PubMed]
11. Georgiade, N.G.; Latham, R.A. Maxillary arch alignment in the bilateral cleft lip and palate infant, using pinned coaxial screw appliance. *Plast. Reconstr. Surg.* **1975**, *56*, 52–60. [CrossRef] [PubMed]
12. Matsuo, K.; Hirose, T.; Otagiri, T.; Norose, N. Repair of cleft lip with nonsurgical correction of nasal deformity in the early neonatal period. *Plast. Reconstr. Surg.* **1989**, *83*, 25–31. [CrossRef] [PubMed]
13. Grayson, B.H.; Santiago, P.E.; Brecht, L.E.; Cutting, C.B. Presurgical nasoalveolar molding in infants with cleft lip and palate. *Cleft Palate Craniofac. J.* **1999**, *36*, 486–498. [CrossRef] [PubMed]
14. van der Heijden, P.; Dijkstra, P.U.; Stellingsma, C.; van der Laan, B.F.; Korsten-Meijer, A.G.; Goorhuis-Brouwer, S.M. Limited evidence for the effect of presurgical nasoalveolar molding in unilateral cleft on nasal symmetry: A call for unified research. *Plast. Reconstr. Surg.* **2013**, *131*, 62e–71e. [CrossRef] [PubMed]
15. Ettorre, G.; Weber, M.; Schaaf, H.; Lowry, J.C.; Mommaerts, M.Y.; Howaldt, H.P. Standards for digital photography in cranio-maxillo-facial surgery—Part I: Basic views and guidelines. *J. Cranio-Maxillofac. Surg.* **2006**, *34*, 65–73. [CrossRef] [PubMed]
16. Monasterio, L.; Ford, A.; Gutiérrez, C.; Me, T.; García, J. Comparative study of nasoalveolar molding methods: Nasal elevator plus DynaCleft® versus NAM-Grayson in patients with complete unilateral cleft lip and palate. *Cleft Palate Craniofac. J.* **2013**, *50*, 548–554. [CrossRef] [PubMed]
17. Williams, E.M.; Evans, C.A.; Reisberg, D.J.; Begole, E.A. Nasal outcomes of presurgical nasal molding in complete unilateral cleft lip and palate. *Int. J. Dent.* **2012**, *2012*, 643896. [CrossRef] [PubMed]
18. Spengler, A.L.; Chavarria, C.; Teichgraeber, J.F.; Gateno, J.; Xia, J.J. Presurgical nasoalveolar molding therapy for the treatment of bilateral cleft lip and palate: A preliminary study. *Cleft Palate Craniofac. J.* **2006**, *43*, 321–328. [CrossRef] [PubMed]
19. Suri, S. Optimal timing for nasal cartilage molding in presurgical nasoalveolar molding. *Plast. Reconstr. Surg.* **2010**, *125*, 112e–113e. [CrossRef] [PubMed]
20. Barillas, I.; Dec, W.; Warren, S.M.; Cutting, C.B.; Grayson, B.H. Nasoalveolar molding improves long-term nasal symmetry in complete unilateral cleft lip-cleft palate patients. *Plast. Reconstr. Surg.* **2009**, *123*, 1002–1006. [CrossRef] [PubMed]
21. Ahmed, M.M.; Brecht, L.E.; Cutting, C.B.; Grayson, B.H. 2012 American Board of Pediatric Dentistry College of Diplomates annual meeting: The role of pediatric dentists in the presurgical treatment of infants with cleft lip/cleft palate utilizing nasoalveolar molding. *Pediatr. Dent.* **2012**, *34*, e209–e214. [PubMed]
22. Grayson, B.H.; Maull, D. Nasoalveolar molding for infants born with clefts of the lip, alveolus, and palate. *Clin. Plast. Surg.* **2004**, *31*, 149–158. [CrossRef] [PubMed]
23. Figueroa, A.A.; Polley, J.W.; Cohen, M. Orthodontic management of the cleft lip and palate patient. *Clin. Plast. Surg.* **1993**, *20*, 733–753. [CrossRef] [PubMed]
24. Liao, Y.F.; Hsieh, Y.J.; Chen, I.J.; Ko, W.C.; Chen, P.K. Comparative outcomes of two nasoalveolar molding techniques for unilateral cleft nose deformity. *Plast. Reconstr. Surg.* **2012**, *130*, 1289–1295. [CrossRef] [PubMed]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.