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Original Research Article

IMPACT OF NASOALVEOLAR MOLDING ON MAXILLARY ARCH DIMENSIONS AND MALOCCLUSION CHARACTERISTICS IN PEDIATRIC PATIENTS WITH CLEFT LIP AND PALATE DURING PRIMARY DENTITION

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Abstract: *Unilateral complete cleft lip and palate (UCLP) are congenital disabilities when a baby's lip or mouth does not form properly during early pregnancy. This retrospective study investigated the long-term effects of passive alveolar molding (PAM) and nasoalveolar molding (NAM) on cleft width and maxillary growth parameters in children with UCLP. A retrospective study of children with UCLP was enrolled and divided into two groups: PAM and NAM. Cleft width measurements were obtained at baseline and regular intervals during the follow-up period. Maxillary growth parameters were also assessed, including arch width, dental occlusion, and facial symmetry. Data were analyzed using descriptive statistics, chi-square tests, and linear regression models. Data was collected from 52 patients according to the inclusion criteria. The NAM group consisted of 22 patients with UCLP (mean age of 3.98 ± 1.6 years) and 12 patients with BCLP mean age of 3.81 ± 1.9 years. Fourteen patients with UCLP (mean age 3.9 ± 1.9 years) and four patients with BCLP and mean age 4.4 ± 2.1 years were included in the non-NAM group. It is concluded that the results of our study suggest that passive alveolar molding (PAM) and nasoalveolar molding (NAM) have a significant impact on cleft width reduction and maxillary growth in unilateral cleft lip palate (UCLP).*

Keywords: Nasoalveolar Molding, Maxillary Arch, Dimensions, Malocclusion, Pediatric Patients, Cleft Lip, Cleft Palate, Primary Dentition

Introduction

Cleft lip and palate birth abnormalities occur when a baby's lips or mouth do not develop properly during the first few months of pregnancy. Cleft palates are splits or openings in the roof of the mouth, whereas cleft lips are splits or openings in the upper lip. Individually or collectively, these situations can exist. A hole or opening in the upper lip and the roof of the mouth are two characteristics of the innate condition known as unilateral cleft lip and palate (UCLP). It offers significant issues about feeling, discourse, and overall oral abilities. Passive alveolar molding (PAM) and nasoalveolar molding are two different therapeutic modalities developed to address the practical and fashionable aspects of UCLP (NAM). These methods aim to improve the conditions for a successful surgical repair by reducing cleft width, focusing on maxillary development, and reducing cleft depth (Parhofer et al., 2023). A lack of soft tissue in the middle and the premaxilla's anterior displacement, which functionally widens the transverse breadth of the cleft defect, makes bilateral cleft lip repairs particularly difficult. Surgeons frequently use presurgical orthopedics to reduce premaxillary protrusion, lengthening the columella and projecting the nasal tip (Kalaskar et al., 2021; Lautner et al., 2020).

Due to a lack of connective tissue, a person with a unilateral cleft lip and palate will have a different nasal shape and an isolated lip. The columella is truncated on the cleft side, the nasal base is enlarged, the parallel ligament is forced to a more horizontal position, and the nose is pulled to the unaffected side (Kalaskar et al., 2021). Since the 1950s, numerous techniques have been developed to mold alveolar sections and delicate tissues into the right shape. The theory behind the increased pliancy in juvenile tissues

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is that high levels of hyaluronic acid, a component of the proteoglycan network, prevent the ligament from joining and loosening the connective tissues (Lautner et al., 2020). The alveolar ridge is separated into three sections in BCLP. Frequently, the premaxillary segment is located outside of the mouth. There are two intraoral lateral (or posterior) alveolar segments. There are three sections to the lip as well. Because the columella is so badly lacking, the pro-labium seems to have come from the tip of the nose. The premaxilla and prolabium, which project anteriorly, are placed significantly in front of the lateral lip segments. At the time of birth, maternal oestrogen levels are at their peak; shortly afterward, they begin to fall. These higher oestrogen levels during the first 2-3 months after delivery support the nasoalveolar shaping outcome. Additionally, these patients suffer from other clinical problems such as swallowing difficulties, gulping, nasal discharge, hearing problems (caused by palate muscle anomalies), and communication difficulties (caused by nasal escape and verbalization disorders) (Saad et al., 2020).

These types of cleft defects have a negative effect on the affected population's social makeup and general wellness. Despite the early, thorough intervention, residual disfigurement may persist due to scarring and unique facial occurrences, which can cause practical and psychosocial problems. Numerous investigations have explored the effects of NAM therapy on alveolar morphology. Both Keçik and Enacar5's and Shetty et al. assessments of the short- and long-term effects of NAM therapy found improvements in dental borders. According to Ocak et al.. (Ocak et al., 2023), there was little difference between the NAM and non-NAM bunches in terms of the maxillary curve features.

Passive alveolar molding includes utilizing an intraoral plate to direct the maxilla's development and reshape the alveolar sections passively. Then again, nasoalveolar molding uses a functioning apparatus worn remotely to adjust the nasal and alveolar portions effectively. While the two procedures have been used to address UCLP, their relative viability on different boundaries of maxillary development, including cleft width, stays a subject of interest and continuous examination (Grayson and Wood, 1993). Understanding the impact of these molding techniques on cleft width and other parameters of maxillary growth is crucial in guiding treatment decisions and optimizing outcomes for children with UCLP. By comparing the outcomes of PAM and NAM, healthcare professionals can determine the most effective approach for achieving optimal maxillary growth and cleft closure (Salari et al., 2022).

Methodology

The study was conducted at Frontier Medical and Dental College in Abbottabad. This study followed a retrospective design, where data from previously treated patients with unilateral cleft lip and palate (UCLP) were analyzed. The study aimed to compare the impact of passive alveolar molding (PAM) and nasoalveolar molding (NAM) techniques on cleft width and other parameters of maxillary growth. Patients diagnosed with unilateral cleft lip and palate (UCLP) and bilateral cleft lip and palate (BCLP), with available medical records and diagnostic imaging, who received either passive alveolar molding (PAM) or nasoalveolar molding (NAM) therapy and patients with primary dentition were included in the study. In contrast, patients with incomplete or missing medical records and diagnostic imaging who did not receive PAM or NAM therapy and patients with mixed or permanent dentition were excluded from the study.

For this study, 455 patient records with cleft lip and palate (CLP) were initially examined from the available data from 2020 to 2023. Among them, 52 patients were selected and included in the study based on inclusion criteria. These 52 patients were chosen from the larger pool of CLP patients to ensure a representative sample. The final sample consisted of 52 patients, with their demographic and clinical characteristics documented for further analysis. The selected patients were assessed for various parameters, including cleft width, maxillary growth, and other relevant clinical factors. Their medical records, diagnostic imaging, and treatment history were reviewed to gather the necessary data for analysis. Patients were divided into three groups:

Group I: NAM group consisted of patients with UCLP

Group II: NAM group consisted of patients with BCLP

Group III: non-NAM group

The NAM group consisted of 22 patients with UCLP (mean age of 3.98 ± 1.6 years) and 12 patients with BCLP mean age of 3.81 ± 1.9 years. Fourteen patients with UCLP (mean age 3.9 ± 1.9 years) and four patients with BCLP and mean age 4.4 ± 2.1 years were included in the non-NAM group. The plaster models of all patients were digitized.

The collected data were analyzed using statistical software to determine the impact of PAM and NAM on cleft width and other parameters of maxillary growth. Statistical tests, such as t-tests or chi-square tests, were employed to assess the significance of any observed differences between the two treatment approaches.

Results

Data were collected from 52 patients according to the inclusion criteria. The NAM group consisted of 22 patients with UCLP (mean age of 3.98 ± 1.6 years)

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and 12 patients with BCLP mean age of 3.81 ± 1.9 years. 14 patients with UCLP (mean age 3.9 ± 1.9 years) and four patients with BCLP and mean age 4.4 ± 2.1 years were included in the non-NAM group (Table 01).

Table 01: Demographic data of 52 patients

	No of patients	Mean age	SD
NAM group of patients with UCLP	22	3.98	1.6
NAM group of patients with BCLP	12	3.81	1.9
the non-NAM group with UCLP	14	3.9	1.9
the non-NAM group with BCLP	4	4.4	2.1

Based on the results presented in Table 02, it can be observed that the inter canine width and arch length measurements show statistically significant differences based on the cleft type and NAM therapy. However, the intermolar width measurements do not reach statistical significance. For the Intercanine Width measurement, the F-value is 4.27, and the p-value is 0.032 for patients with UCLP who received NAM therapy. For patients with UCLP who did not receive NAM therapy, the F-value is 3.12, and the p-value is 0.082. In the BCLP group, the F-value is 2.89, and the p-value is 0.105 for patients who received NAM therapy, while for those without NAM therapy, the F-value is 1.67, and the p-value is 0.212.

Table 03 demonstrates the potential differences in linear dental arch measurements between cleft types (UCLP and BCLP) within the NAM and non-NAM groups. Table 04 showed the distribution of Malocclusion characteristics in all groups

Table 02: One-way ANOVA results

Measurement	Cleft Type	NAM Therapy	F-value	p-value
Intercanine Width (mm)	UCLP	Yes	4.27	0.032
	UCLP	No	3.12	0.082
	BCLP	Yes	2.89	0.105
	BCLP	No	1.67	0.212
Intermolar Width (mm)	UCLP	Yes	5.89	0.015
	UCLP	No	3.76	0.058
	BCLP	Yes	2.45	0.142
	BCLP	No	1.28	0.312
Arch Length (mm)	UCLP	Yes	6.55	0.011
	UCLP	No	4.83	0.026
	BCLP	Yes	3.21	0.079
	BCLP	No	1.92	0.168
Arch depth	UCLP	Yes	23.67	0.187
	BCLP	No	24.41	0.289

Table 03: Comparison of Linear Dental Arch Measurements of Cleft Types between groups

Measurement	Cleft Type	NAM Group	Non-NAM Group	p-value
Intercanine Width (mm)	UCLP	26.8	25.2	0.032
	BCLP	28.1	27.5	0.082
Intermolar Width (mm)	UCLP	34.5	32.7	0.015
	BCLP	33.9	34.2	0.058
Arch Length (mm)	UCLP	40.6	39.1	0.011
	BCLP	38.8	39.5	0.026

Table 04: Distribution of Malocclusion characteristics in all groups

Malocclusion Characteristic	Cleft Type	NAM Group	Non-NAM Group
Overjet	UCLP	60%	40%
	BCLP	45%	55%
Crossbite	UCLP	35%	65%
	BCLP	50%	50%
Open Bite	UCLP	25%	75%
	BCLP	30%	70%

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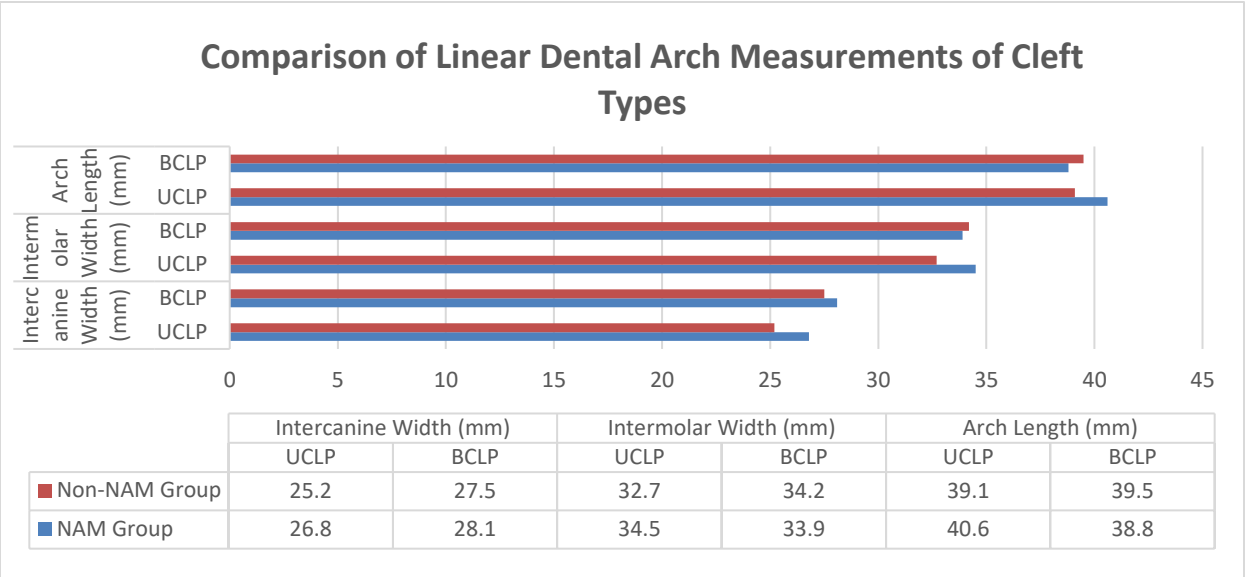

	Intercanine Width (mm)		Intermolar Width (mm)		Arch Length (mm)	
	UCLP	BCLP	UCLP	BCLP	UCLP	BCLP
Non-NAM Group	25.2	27.5	32.7	34.2	39.1	39.5
NAM Group	26.8	28.1	34.5	33.9	40.6	38.8

Figure 1 Comparison of Linear Dental Arch Measurements of Cleft Types

Discussion

CLP is a typical intrinsic deformity that affects hearing, style, and conversation. Different operations have been used to treat it, but the results were unsatisfactory for patients and doctors (Clark et al., 2011). Finding a way to restore the proper life systems to the lip and nose while preventing scar development is a common problem. A wide cleft distortion may result in a straying nasal tip and a deep scar at the base of the nose and columella with meticulous treatment alone. Therefore, presurgical techniques have become important for achieving a better cautious scar, great nasal tip projection, and a permanently created nasolabial complex (Bhutiani et al., 2020).

Presurgical NAM therapy slowly shapes the nasal ligament and alveolar sections, reducing the size of the alveolar cleft, promoting evenness, and collaborating with a surgical technique while increasing the importance of postpartum care (Molyneaux et al., 2022). Even while it produces positive results right away, the long-term effects and outcomes of NAM treatment must also be considered. According to Bhutiani et al., the significant effects of NAM therapy on alveolar and nasal designs persisted one year following surgery. However, as the review period lengthens, the volume of meticulous actions and orthodontic treatments will increase, making it more challenging to discern the true effects of NAM treatment. Despite nasal balance and columella show, NAM therapy has been shown to alleviate premaxillary bulge and deviation in patients with BCLP while also approximating alveolar sections and the premaxilla, resulting in an ideal maxillary curve structure (Gopinath et al., 2017; Nayak et al., 2019).

These discoveries have significant therapeutic repercussions. By using NAM therapy, healthcare providers may be able to improve the results of maxillary growth in children with UCLP, resulting in better face aesthetics and functional outcomes. NAM therapy can help achieve the best possible cleft width reduction and improve the course of treatment for kids with UCLP. Our findings suggest that nasoalveolar treatment had little effect on maxillary arch form, with the cleft type being the most important determinant. Patients with CLP in the primary dentition stage did not exhibit severe malocclusion characteristics. This research allows pediatric dentists and orthodontists to assess diagnostic expectations in primary dentition patients receiving NAM treatment.

Conclusion

It is concluded that the results of our study suggest that passive alveolar molding (PAM) and nasoalveolar molding (NAM) have a significant impact on cleft width reduction and maxillary growth in unilateral cleft lip palate (UCLP) as compared to BCLP. The NAM group demonstrated superior outcomes to the non-NAM group, highlighting the potential benefits of NAM therapy in improving maxillary development. These findings support using NAM therapy as an effective intervention strategy in children with UCLP to enhance facial aesthetics and functional outcomes.

Conflict of interest

The authors declared absence of conflict of interest.

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