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Original Research Article

A Study to Assess the Stability of the Nasal Symmetry Achieved by NAM in Unilateral Cleft Lip and Palate (UCLP) Patients: A Longitudinal Assessment

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Abstract

Aim: The aim of the present study was to assess the stability of the nasal symmetry achieved by NAM in unilateral cleft lip and palate (UCLP) patients.

Methods: This research was conducted in the Department of Plastic Surgery and in accordance with the Helsinki Declaration. In this retrospective study, consecutive NAM-treated UCLP patients, whose serial photographs were available, were studied. In this retrospective study, the basal photographs of 30 consecutive NAM-treated UCLP patients were studied longitudinally to evaluate the stability of NAM.

Results: In the immediate postcheiloplasty period (T1), the nasal height ratio, the nasal width ratio, hemicolumella height and alar base width ratio were almost perfectly symmetrical, and the mean columella deviation angle was 88.72°. In comparison to the baseline values obtained postoperatively (T1), the loss of symmetry was significant across all parameters at all the time durations (T2, T3, and T4). The mean columella deviation angle was lost by 1.56% at the end of T2 follow-up (p-0.007), 2.80% at the T3 follow-up (p-0.003) and 3.44% at T4 follow-up ($p < 0.001$). The nostril height on the cleft side was lost by 14.06% at the T2 follow-up ($p < 0.001$), 18.88% at T3 follow-up ($p < 0.001$), and 21.87% at the T4 follow-up ($p < 0.001$). The nostril width on the cleft side increased by 38.12% at the T2 follow-up ($p < 0.001$), 40.44% at the T3 follow-up ($p < 0.001$), and 40.28% at the T4 follow-up ($p < 0.001$). The hemicolumella length on the cleft side was lost by 12.48% at the T2 follow-up ($p < 0.001$), 18.36% at the T3 follow-up ($p < 0.001$), and 24.86% at the T4 follow-up ($p < 0.001$). The alar base width on the cleft side increased by 18.82% at the T2 follow-up ($p < 0.001$), 26.14% at the T3 follow-up ($p < 0.001$), and 40.66% at the T4 follow-up ($p < 0.001$).

Conclusion: In this study, we found that NAM was a useful adjuvant in achieving nasal symmetry in patients with UCLP in the immediate postoperative period. However, as the patients aged, there was a gradual loss of symmetry. Although there is no conclusive evidence, the loss of symmetry may be due to the unequal growth on the cleft and noncleft sides.

Keywords: cleft lip, cleft nose, nasal symmetry, nasoalveolar molding.

Introduction

The nasal deformity is an abnormality in the structure and appearance of the nose, which involves the displacement of lower lateral nasal cartilage, oblique and short columella, depressed dome, overhanging nostril apex, and deviated septum. Difficulties in breathing and smelling are the main problems of this deformity. One of the main types of nasal deformity is unilateral cleft lip or palate (UCL/P). The reconstruction of facial soft tissue is the most challenging issue in these patients. [1]

The worldwide prevalence of the UCL/P is 0.5-3 cases per 1000 births. Genetic and local factors are the etiology of this problem. Moreover, the frequency of this deformity differs among people in terms of gender, population, and maternal features. The female/ male ratio in children with UCL/P is 1:2, and it is more common in the Caucasian population. [2] Rhinoplasty for UCL/P patients is very complicated and should be performed with caution due to the complex nature of the unilateral cleft nasal deformity.

There are several surgical approaches to correct the cleft lip tissue; however, wide and bilateral clefts have remained a remarkable challenge. [3] For this reason, presurgical infant orthopedics were introduced to manage the floating premaxilla and align the alveolar bone of maxilla. [4] Grayson et al [5] introduced presurgical nasoalveolar molding

(PNAM) in 1999 in which the alveolar segments and deformed lower lateral cartilages are repositioned via active molding prior to the primary cheiloplasty. The main goals of PNAM therapy are the correction of the normal arc of alveolar segments and decrease the cleft gap.

The study conducted by Clark et al [6] indicated the improvement in the long-term nasal symmetry in patients who had NAM in combination with alveolar molding, compared with those without NAM. Moreover, they showed long-term clinical improvement in nasal and lip anatomy but not in dental arch configuration, as well as occlusion of patients who underwent NAM, compared with those without NAM. A remarkable improvement in nasal symmetry and normalization of the dental arch was demonstrated in a short-time study conducted by Ezzat et al. [7] Based on a study performed by Jaeger et al., NAM therapy may lead to nostril overexpansion.

The aim of the present study was to assess the stability of the nasal symmetry achieved by NAM in unilateral cleft lip and palate (UCLP) patients.

Materials and Methods

This research was conducted in the Department of Plastic Surgery, Nalanda Medical College and Hospital, Patna, Bihar, India for one year and in accordance with the Helsinki Declaration. In this retrospective study, consecutive NAM-treated UCLP patients, whose serial photographs were available, were studied. In this retrospective study, the basal photographs of 30 consecutive NAM-treated UCLP patients were studied longitudinally to evaluate the stability of NAM.

Patients with incomplete clefts and other craniofacial anomalies were excluded from this study. All infants who had arrived at the center before 6 weeks of age were treated with Eric Liou's technique of NAM [8] for an average of 4 months. The patients were called every 2 weeks to make adjustments to the device. Six weeks was used as a cutoff, since the pliability of the nasal cartilage reduces as the child ages. [9] The patients were treated with modified Millard's cheiloplasty at an average age of 6 months of age without primary rhinoplasty or gingivoperiosteoplasty. One-stage palatoplasty was carried out along with Bardach's technique, with repositioning of the soft palate musculature (Sommerlad). [10] All the surgeries were performed by the same two surgeons. A total of 24 patients were included in this study. Standardized 2D full-face frontal view and worm's eye photographs were shot by the same experienced cleft worker postcheiloplasty (T1), at 1-year follow-up (T2), at 3-year follow-up (T3), and 5-year follow-up (T4) appointments. No rhinoplasty had been conducted on any of the patients during the follow-up period.

A ratio of 1:1 basal photographs were used for various measurements, as mentioned in literature. [11,12] A horizontal reference line was constructed by connecting the most inward points at the outer lateral borders of the cleft and noncleft nostrils. [12] Four linear measurements (nostril height, nostril width, alar base width, and columella height) and one angular measurement (columella deviation angle) were measured directly on the photographs. To minimize errors in this technique, the linear measurements were evaluated as ratios. All measurements were done by a single independent surgeon who had not treated any of the patients in this study.

Data collected from the study group was analyzed with SPSS version 18 and repeated measures of ANOVA were used to compare the nasal symmetry at each of the intervals to the baseline values. The level of significance was set at $p < 0.05$.

Results

Table 1: Angle and ratios of the various parameters measured

Parameter	Postcheiloplasty	1-year follow-up	3-year follow-up	5-year follow-up
Columella deviation angle	88.72°	87.33°	86.24°	85.55°
Nasal height ratio	1.03	0.86	0.82	0.78
Nasal width ratio	1.05	1.36	1.43	1.43
Columella length ratio	1.08	0.94	0.86	0.78
Alar base width ratio	0.96	1.14	1.22	1.36

In the immediate postcheiloplasty period (T1), the nasal height ratio, the nasal width ratio, hemicolumella height and alar base width ratio were almost perfectly symmetrical, and the mean columella deviation angle was 88.72°. In comparison to the baseline values obtained postoperatively (T1), the loss of symmetry was significant across all parameters at all the time durations (T2, T3, and T4).

Table 2: % of change in the various parameters from the baseline

Parameters	% variation	1 year	3 years	5 years
Columella deviation angle	%	1.56%	2.80%	3.44%
Nasal height ratio	%	14.06%	18.88%	21.87%
Nasal width ratio	%	38.12%	40.44%	40.28%
Columella length ratio	%	12.48%	18.36%	24.86%
Alar base width ratio	%	18.82%	26.14%	40.66%

The mean columella deviation angle was lost by 1.56% at the end of T2 follow-up (p-0.007), 2.80% at the T3 follow-up (p-0.003) and 3.44% at T4 follow-up ($p < 0.001$). The nostril height on the cleft side was lost by 14.06% at the T2 follow-up ($p < 0.001$), 18.88% at T3 follow-up ($p < 0.001$), and 21.87% at the T4 follow-up ($p < 0.001$). The nostril width on the cleft side increased by 38.12% at the T2 follow-up ($p < 0.001$), 40.44% at the T3 follow-up ($p < 0.001$), and 40.28% at the T4 follow-up ($p < 0.001$). The hemicolumella length on the cleft side was lost by 12.48% at the T2 follow-up ($p < 0.001$), 18.36% at the T3 follow-up ($p < 0.001$), and 24.86% at the T4 follow-up ($p < 0.001$). The alar base width on the cleft side increased by 18.82% at the T2 follow-up ($p < 0.001$), 26.14% at the T3 follow-up ($p < 0.001$), and 40.66% at the T4 follow-up ($p < 0.001$).

Discussion

Nasal deformity is a main feature of unilateral cleft lip/ palate (UCL/P). It is characterized by a displaced lower lateral nasal cartilage, oblique and short columella, depressed dome, overhanging nostril apex, and deviated septum. Because of the complicated nature of unilateral cleft nasal deformity, rhinoplasty is often a great challenge to cleft surgeons. Presurgical nasoalveolar molding (PNAM) was first described by Grayson et al in 1999. [5] PNAM involves the repositioning of the alveolar segments and deformed lower lateral cartilages by active molding in the neonatal period prior to the primary cheiloplasty. The alveolar segments, premaxilla, and surrounding soft tissue gradually shift to their normal anatomical positions.

In the immediate postcheiloplasty period (T1), the nasal height ratio, the nasal width ratio, hemicolumella height and alar base width ratio were almost perfectly symmetrical, and the mean columella deviation angle was 88.72°. In comparison to the baseline values obtained postoperatively (T1), the loss of symmetry was significant across all parameters at all the time durations (T2, T3, and T4). The mean columella deviation angle was lost by 1.56% at the end of T2 follow-up (p-0.007), 2.80% at the T3 follow-up (p-0.003) and 3.44% at T4 follow-up ($p < 0.001$). Our T2 results were similar to the 1-year results reported by Pai et al [11] the 9-month results reported by Tang et al [13] and the 1-year results reported by Liou et al. [12] Deficient columella, overhanging nasal apex, and depressed dome have remained as the main problems after cheiloplasty. [14,15] Based on one study, a reduction in the deficient columella, depressed dome, wide alar width, and deviated nasal septum were reported after using PNAM. [16] A comparative study conducted by Liang et al. on the long-term effect of the nasal contour between patients underwent NAM and those without NAM revealed that NAM improved nasal symmetry after cheiloplasty. [17]

The nostril height on the cleft side was lost by 14.06% at the T2 follow-up ($p < 0.001$), 18.88% at T3 follow-up ($p < 0.001$), and 21.87% at the T4 follow-up ($p < 0.001$). The nostril width on the cleft side increased by 38.12% at the T2 follow-up ($p < 0.001$), 40.44% at the T3 follow-up ($p < 0.001$), and 40.28% at the T4 follow-up ($p < 0.001$). The hemicolumella length on the cleft side was lost by 12.48% at the T2 follow-up ($p < 0.001$), 18.36% at the T3 follow-up ($p < 0.001$), and 24.86% at the T4 follow-up ($p < 0.001$). The alar base width on the cleft side increased by 18.82% at the T2 follow-up ($p < 0.001$), 26.14% at the T3 follow-up ($p < 0.001$), and 40.66% at the T4 follow-up ($p < 0.001$). McNeil described the modern concept of presurgical maxillary orthopedics in 1950. This approach is still preferred and applied in various types of neonatal maxillary orthopedic appliances. Active, semi-active, and passive devices are the main types of this approach. In active appliances, some force applies to the alveolar segments and move them in a specified side by some appliances, such as spring or screw. In semi-active appliances, the dental cast is divided into sections, and the position of maxillary segments is changed to a more favorable place and forces the palatal segments in a predetermined position when the pre-made plate is placed in the oral cavity. [18] In passive appliances, certain regions of the palate are exposed to grinding away acrylic material. The reason for this is to induce arch alignment during growth, which focused on the correct spontaneous development of the segments and prevented the collapse of cleft segments. [18,19] In nasoalveolar molding, the stent is inserted into the affected nostrils and helps to reform, expand, and reposition the external nasal structures. Accordingly, the palatal segments are repositioned by the intraoral plate. This act is performed when the baby is sleeping.[19]

Conclusion

In this study, we found that NAM was a useful adjuvant in achieving nasal symmetry in patients with UCLP in the immediate postoperative period. However, as the patients aged, there was a gradual loss of symmetry. Although there is no conclusive evidence, the loss of symmetry may be due to the unequal growth on the cleft and noncleft sides. These patients will be followed-up till end of growth for a definite conclusion on the long-term effect of NAM.

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