

CLINICAL STUDY

Nasoalveolar molding in complete cleft lip nasal deformity patients

Fedeles J Jr¹, Ziak P², Fedeles J²

Department of Hand Surgery, Reconstructive and Aesthetic Surgery, Comenius University Hospital, Bratislava, Slovakia. fedelesmd@gmail.com

Abstract: *Objectives:* The aim of this study was to compare nostril height, width, collumelar length, interalar distance and nostril symmetry between unilateral complete cleft lip/palate patients undergoing nasoalveolar moulding (NAM) and incomplete cleft lip patients/palate with no need of presurgical moulding before and after cheiloplasty with primary nasal correction. Our study group included 18 patients from whom 9 were NAM cleft lip/palate nasal deformity cases and 9 incomplete cleft lip/palate cases. All measurements were obtained by two independent investigators and averaged, standard deviations and symmetry ratios were calculated, and paired and unpaired t-test was performed to compare the groups.

Results: Our study results showed no statistically significant difference in nostril height, width, collumelar length, interalar distance in unilateral cases in preoperative and postoperative measurements between these two groups. Symmetry measurements included nostril width on the affected and nonaffected side, nostril height on the affected and nonaffected side before (T1) and after (T2) cheiloplasty. The nostril height ratio was 1.2 and 1.03 for T1 to T2 and the nostril width revealed a ratio of 0.5 and 0.8 for T1 to T2 in unilateral NAM cases. In the incomplete cleft lip group the height ratio was 1.04 and 1.03 for T1 to T2 and the width ratio was 0.59/0.93 in pre-/postoperative measurements. These symmetry values showed also no statistical significance between NAM and incomplete cleft lip cases.

Conclusion: Our study results showed no statistical significant difference in nostril height, width, collumelar length, interalar distance and nostril symmetry between unilateral complete cleft lip/palate patients undergoing NAM and incomplete cleft lip patients/palate with no need of presurgical moulding, proving NAM combined with primary nasal correction is a very efficient management for cleft lip/palate children with outstanding results (Tab. 5, Fig. 4, Ref. 25). Full Text in PDF www.elis.sk.

Key words: nasoalveolar molding, complete cleft lip nasal deformity, cleft lip, nostril height, width, collumelar length, interalar distance, nostril symmetry.

Correction of the complete cleft lip nasal deformity remains one of the greatest challenges faced by cleft surgeons. There have been several attempts at restoring the normal anatomy of the nose at the time of lip repair in the affected individuals with varying degrees of success.

In unilateral complete cleft lip cleft-cleft palate, the ipsilateral lower cartilage is displaced posteriorly, inferiorly, and laterally, resulting in a depressed dome and shortened columella. The lack of bony support and deviated nasal septum shifts the base of the columella to the noncleft side, increasing the cleft nostril rim length (1, 2, 3).

The management of cleft patients have evolved dramatically in recent years. Outcome is improving because of better surgical techniques, timing, and incorporation of procedures like presurgical orthopedics (4). Grayson et al. designed a nasal stent in con-

junction with an orthopedic oral plate to simultaneously mold the nose and the cleft alveolar segments (5, 6).

Preoperative nasoalveolar molding raises the position of the unilateral cleft-side lower lateral cartilage to higher step on the staircase of nasal symmetry (7). At national cleft centre in Bratislava, Slovakia we use Grayson's method of presurgical nasoalveolar molding (NAM) starting at second week after birth (Fig. 1). Surgical protocol includes modification of Millard's rotation-advancement technique (8), which is used for cheiloplasty in unilateral cleft lip/palate and Black's (9) or Cutting-/Grayson's technique (5) for bilateral cleft lip/palate. Noordhoff's method of nasal transfixion sutures are placed to correct the nasal deformity without the nasal rim incision (10). Most of the patients undergo primary lip surgery in the time period of 3–6 months and in few cases later only due to pediatric reasons (11).

Subjects and methods

Eighteen cases of clefts of lip and palate with nasal deformity were subjected to present study from July 2009 to August 2010. These cases were initially treated on outpatient basis, and they were admitted at the time of operation. All of these patients were children of less than 6 months of age, belonging to Slovak popu-

¹Department of Hand Surgery, Reconstructive and Aesthetic Surgery, Comenius University Hospital, Bratislava, Slovakia, and ²Department of Plastic, Reconstructive and Aesthetic Surgery, Comenius University Hospital, Bratislava, Slovakia

Address for correspondence: J. Fedeles, MD, PhD, Department of Hand Surgery, Reconstructive and Aesthetic Surgery, Comenius University Hospital, Bratislava, Slovakia



Fig. 1. Nasoalveolar molding plate.

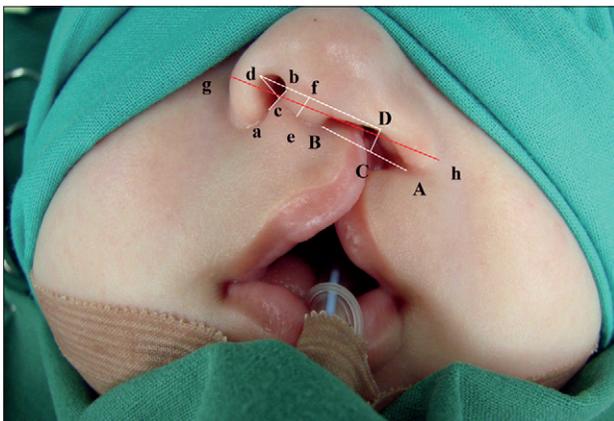


Fig. 2. Preoperative measurement.

lation. The experimental group had 6 patients of unilateral cleft nose deformity and 3 patients of bilateral cleft nose deformity. The control group consisted of 9 patients with incomplete unilateral cleft lip deformity. The duration of the NAM ranged from 1 to 6 months. Parents were explained about the cleft deformity and various stages of treatment, although in few cases there was a lower parental compliance. All of the control group patients had no

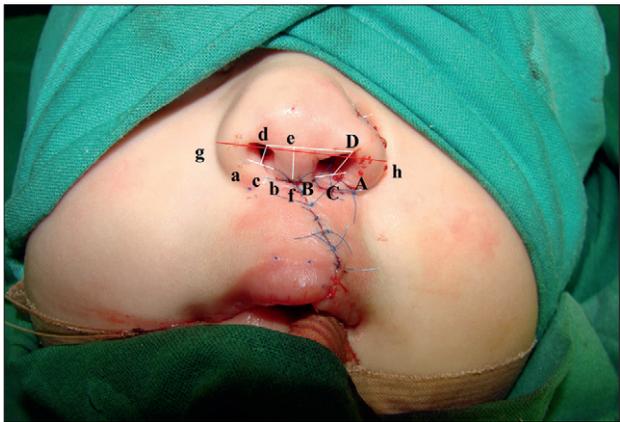


Fig. 3. Postoperative measurement.

presurgical nasoalveolar molding, and these were operated by the same team of surgeons using the similar technique of repair with primary nasal correction. All pre- and postoperative measurements were obtained by two independent investigators and averaged.

Following measurement reference points were used for different measurements (Figs 2 and 3):

- a) alar base nonleft side
- b) columellar base nonleft side
- c) midpoint of a-b, centre of floor of the nose
- d) the highest point on the alar rim nonleft side
- e) midpoint at the base of columella
- f) the highest point in the midline of columella
- g) most lateral point of alar cartilage nonleft side
- h) most lateral point of alar cartilage cleft side
- A) alar base cleft side
- B) columellar base cleft side
- C) midpoint of A-B, centre of floor of the nose
- D) the highest point on the alar rim nonleft side

These measurements included the following:

Height of the nostril = distance from midpoint of floor of nose to the highest point on alar rim, ie, c – d or C – D



Fig. 4. A – preoperative status, B – postoperative status.

Tab. 1. Comparison of the nostril height in unilateral cases.

Unilateral cases (N=15)		Cases with NAM mean (SD), mm	Cases without NAM mean (SD), mm	t	p
Preoperative results	Noncleft	5.389 (0.753)	5.389 (1.167)	0.82	0.43
	Cleft	4.75 (3.711)	5.167 (1.275)	0.32	0.75
Postoperative results	Noncleft	5.917 (0.801)	5.444 (1.102)	0.90	0.39
	Cleft	5.750 (2.092)	5.278 (0.755)	0.63	0.54

Tab. 2. Comparison of the nostril width in unilateral cases.

Unilateral cases (N=15)		Cases with NAM mean (SD), mm	Cases without NAM mean (SD), mm	t	p
Preoperative results	Noncleft	5.833 (1.329)	5.444 (1.446)	0.53	0.61
	Cleft	11.583 (3.007)	10.278 (2.841)	0.85	0.41
Postoperative results	Noncleft	5.583 (1.158)	5.556 (0.917)	0.05	0.96
	Cleft	7.000 (1.761)	6.000 (1.561)	1.16	0.27

Tab. 3. Comparison of columellar length in unilateral cases.

Unilateral cases (N=15)	Cases with NAM mean (SD), mm	Cases without NAM mean (SD), mm	t	p
Preoperative results	7.167 (1.506)	6.389 (1.635)	0.93	0.37
Postoperative results	8.250 (2.275)	7.167 (1.696)	1.06	0.31

Tab. 4. Comparison of interalar distance in unilateral clefts.

Unilateral cases (N=15)	Cases with NAM mean (SD), mm	Cases without NAM mean (SD), mm	t	p
Preoperative results	28.83 (2.71)	28.11 (2.09)	0.58	0.57
Postoperative results	25.50 (3.15)	23.44 (2.65)	1.37	0.19

Width of the nostril = distance between alar base and columellar base, ie, a – b or A – B

Perimeter of alar rim = distance between a – d – b or A – D – B

Length of the columella = distance between e – f

Interalar distance = distance between g – h

After the data points were collected, the ratios between the cleft and noncleft side measurements were determined, and the NAM and control group were compared (Tabs 1–5). Standard deviations were calculated, and paired and unpaired t-test was performed to compare the groups. In bilateral cleft NAM cases we only compared the pre- and postoperative results with no

control group. A value of $p < 0.05$ was considered statistically significant.

Results

Height, width of the nostrils, columellar length and interalar distance in unilateral deformities.

In unilateral clefts preoperative difference in nostril height on noncleft side was lower in the experimental group than the control group ($p = 0.43$), while cleft side in both groups were almost similar ($p = 0.75$). In postoperative results there was also no significant difference in cleft and non cleft height of the nostril between these two groups ($p = 0.39, 0.54$) (Tab. 1). The nostril width was reduced more after cheiloplasty in the cleft side with no statistical significance between the experimental and control group ($p = 0.027$) (Tab. 2). Comparison of columellar lengthening shows that postoperative lengthening of columella is higher in NAM group, but statistical significance was not proven ($p = 0.31$) (Tab. 3). Interalar distance was insignificantly reduced in both groups ($p = 0.19$) (Tab. 4).

Pre- and postoperative results in bilateral clefts

In bilateral cleft cases we achieved columellar elongation of 15.5 % and a reduction of interalar distance of 10.4 % (Tab. 5).

Cleft symmetry

In all cleft lip patients direct measurements included nostril width on the affected and nonaffected side, nostril height on the affected and nonaffected side before (T1) and after (T2) cheiloplasty. The nostril height ratio was 1.2 and 1.03 for T1 to T2 and the nostril

Tab. 5. Measurement results in bilateral clefts with NAM.

Bilateral cases (N=3)		Preoperative mean (SD),mm	Postoperative mean (SD),mm	Change mm	Change %
Length	right side	8 (2.646)	6.167 (0.7638)	1.833	23.5
	left side	6.33 (6.028)	6 (2.291)	0.333	5.25
Width	ride side	9.5 (1.323)	7.667 (2.082)	1.833	19.3
	left side	10 (3.464)	8.333 (0.7638)	1.667	16.67
Columellar length		6.333 (1.155)	7.5 (1.323)	1.167	15.56
Interalar distance		32 (2)	28.67 (2.309)	3.33	10.41

width revealed the ratio of 0.5 and 0.8 for T1 to T2 in unilateral NAM cases. In the incomplete cleft lip group the height ratio was 1.04 and 1.03 for T1 to T2 and the width ratio was 0.59/0.93 in pre-/postoperative measurements. These symmetry values showed no statistical significance between the experimental and control group. In bilateral cases the preoperative height ratio was 0.79 and 0.97 direct after cheiloplasty. The nostril width showed the ratio of 1.05 and 1.08 for T1 to T2 comparing right cleft side to the left cleft side (Figs 4a, b).

Discussion

McNeil (12) first initiated the use of a dental plate and extra-oral forces for maxillary alignment. Brogan (13) made presurgical orthopedics an integral part of his cleft protocol. Grayson (5) performs the nasal molding with alveolar approximation, emphasizing complete approximation of the alveolus and avoiding overstretching of the nasal cartilage. In addition to aligning the alveolar segment and lips, nasoalveolar molding treats the cleft nasal deformity by correcting the depressed lower lateral cartilages, deviated septum, short columella and splayed alar base. Nasoalveolar molding capitalizes on the cartilaginous plasticity and pliability, which is thought to persist in the neonate for nearly 3 months because of elevated estrogen which triggers an increase in hyaluronic acid levels (14,15). The hyaluronic acid interacts with cartilage proteoglycans, increasing cartilage, ligament, and connective tissue elasticity by breaking down the intercellular matrix (16). Nevertheless, molding does not excuse the surgeon from the need to position and secure the dislocated and slightly splayed lower lateral cartilage (17). The combined benefits of improved nasal symmetry and appearance and decreased number of nasal and dentoalveolar procedures provides a substantial and psychological savings for the patient (18, 19). Studies in the last decade demonstrated correction of nasal deformity by stretching of the nasal mucosal lining, and achievement of nonsurgical columella elongation producing a longterm maintenance in combination with molding of the alveolar process and nose in cleft patients (20). In all studies patient obtained significant reduction of the alveolar gap and primary nasal positioning, significantly improved nasal symmetry and nostril shape (21). Long term studies on NAM therapy indicate better lip and nasal form, reduced oronasal fistula and labial deformities, 60 % reduction in the need for secondary alveolar bone grafting. No effect on growth of midface in sagittal and vertical plane has been recorded up to the age of 18 years. With proper training and clinical skills NAM has demonstrated tremendous benefit to the cleft patients as well as to the surgeon performing the repair (22).

Of the soft and hard tissue complications in presurgical nasoalveolar molding therapy considered only one (tissue irritation) had an estimated incidence greater than 10 %. Compliance issues were of greater concern, with an estimated incidence of 30 % for broken appointments and an estimated incidence of 26 % for removal of the nasoalveolar molding appliance by the tongue (23).

Our early study results showed no statistically significant difference in nostril height, width, columellar length, interalar distance and nostril symmetry between unilateral complete cleft lip/palate patients undergoing NAM and incomplete cleft lip patients/palate with no need of presurgical moulding, proving NAM combined with primary nasal correction is a very efficient management for cleft lip/palate children with outstanding results. We were unable to find similar studies comparing complete orofacial cleft cases after NAM to incomplete cleft lip/palate patients in available publications and literature. We accept the limitations of the present study in terms of small sample size, variation in sample size, and smaller follow-up period. It will definitely be better to have a more robust data from many centers with longer follow-ups to produce more scientifically justified reports.

Conclusion

The application of NAM facilitated primary nasal positioning, significantly improving nasal symmetry and nostril shape reduction of the alveolar gap. NAM constitutes an important adjunct to ameliorate the results of primary definitive lip repair while also improving the surgeon's ability to achieve nasal symmetry. It can prove to be a cost-effective technique by reducing the number of future surgeries in cleft patients. Studies with wider patient base and longer follow-ups are needed for definitive results.

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Received September 26, 2010.

Accepted February 14, 2012.