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Comparative analysis of preoperative and postoperative nasal appearance following unilateral complete cleft lip repair in Kano

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Abstract

Background: Cleft of the lip even after primary repair is reported to show residual deformities especially affecting the nose. The correction of nasal asymmetry is believed to be most challenging and has contributed greatly to modifications and improvement in surgical techniques. The aim of this study was to evaluate the nasal outcome using the symmetry of the nose in children with unilateral complete cleft lip following primary repair in Kano.
Methods: This was a prospective analysis of the nasal outcome in children with unilateral complete cleft lip with or without palate. Preoperative and postoperative measurement of the nostril height, nostril width and alar base width were assessed using the symmetry index by Amaratauga et al. Measurements were done using a digital caliper. Data analysis was done using the paired t-test.
Results: It showed that only the nostril width had statistically significant asymmetry ($p<0.05$) postoperatively. However, using the ANOVA, the nostril height of the unilateral complete cleft of the lip and palate was most asymmetrical ($p= 0.019$) among the component forms of unilateral complete cleft.
Conclusion: A properly done primary lip repair alone may not sufficiently address the problems of the cleft nose, the incorporation of primary rhin.oplasty into primary cleft lip repair will meet the expectation of parents and children born with cleft.

Keywords: Anthropometry, Nasal symmetry, Unilateral complete cleft lip.

Introduction

Distortion of the nose and lip are commonly seen in children with unilateral complete cleft lip with or without palate.[1] This usually presents as a widened nostril orifice, flattened nostril dome, deviated nasal tip and a gap in the upper lip on the affected side.[2] Although, factors such as severity of the cleft, type of cleft, techniques of repair, experience of the surgeon among others influences the outcome of unilateral complete cleft lip repair, the nose repair is reported to be the most challenging.[3,4]

Currently, there is no generally accepted system for grading cleft severity. It is believed that the larger the cleft gap, the more difficult it is to achieve symmetry of nose and lip parameters.[5] Most

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techniques of repair will require sufficient undermining of abnormal Orbicularis oris muscle attachment in addition to well-defined dimensions of overlying skin markings to achieve a satisfactory outcome.[2] These outcomes may be perceived to be satisfactory based on facial appearance peculiar to an ethnic group or population.[6] For example, the nasal tip projection that is usually flattened out in children with cleft may significantly affect the child appearance following repair if this projection is not restored. However, this may not be the case in black population who are known to have a flat nasal tip.[7,8] Abnormalities in the face are believed to be less conspicuous where they occur bilaterally. Thus residual abnormalities following cleft repair is believed to be less disfiguring where they appear bilaterally.[9] Therefore, the less asymmetry of nasal and lip dimensions following cleft repair, the better the perceived outcome. While the nasal tip deviation or nasal tip projection may arguably not impact greatly on the outcome cleft repair in the Hausa population of northern Nigeria, asymmetry in the nostril height, nostril width and alar base width may significantly affect the appearance of the nose and ultimately the outcome in this group of people.[7]

Various studies have reported varying outcomes of unilateral complete cleft lip repair based on lip and nasal anthropometry or indices,[10,11] however, residual abnormalities of the nose following cleft lip repair may impact facial appearance differently for different populations.[12] Achieving symmetry in the nostril dimensions may be one vital way of achieving satisfactory outcome regardless of the race. Thus, the aim of this study was to compare the preoperative and postoperative nasal appearance of children with unilateral complete cleft lip in Kano.

Materials and method

This was a prospective analysis of unilateral complete cleft lip repairs carried out at the Oral and Maxillofacial Surgery unit of two Smile Train sponsored hospitals in Kano state, Nigeria; Aminu Kano Teaching Hospital (AKTH), and the Armed Forces Specialist Hospital (AFSH). Cleft care in AFSH is organized by the Grass-root Smile Initiative (GSI), a non-governmental organization. Ethical approval for the study was obtained from the ethics and research committee of the Aminu Kano teaching hospital, and the Kano state ministry of health.

The sample size was determined by using the formula for comparative research studies. The anthropometric data from a similar study reported the philtral height of the study group had a mean outcome of 12.mm with a standard deviation of 2.3mm. The control group had a mean outcome of 11.82mm with a standard deviation of 1.71mm.

The equation ;

$N = (Z_{\alpha}+Z_{1-\beta})^2(\sigma_1-\sigma_2) / (U_1-U_2)^2$ was used to calculate the sample size.

Where N = minimum sample size required in each group: study and comparative

Z_{α} = propability that if the 2 groups differ, this reflects a true difference in the 2 populations othdrwise known as confidence level set at 95% corresponding to 1.96 from the normak distribution table.

$Z_{1-\beta}$ = this is the power of the study. It is the probability that if the 2 populations differ ,the samplenwould show significant differences. For the study ,this was set at 80% equivalent to 0.842 on the normal distribution table.

σ_1 = standard deviation of the study

σ_2 = standard deviation of the control

U_1 = mean outcome of the study

U_2 = mean outcome of the control

A value of 37.2 approximated to 38 patients minimum participants per group was initially derived as sample size but provision was made for 10% rate of attrition. An additional 4 participants per group was subsequently added to the sample size resulting in 42 patients per group.

The study which involved children with unilateral complete cleft lip with/without palate aged three months to one year whose parents gave informed consent to participate in the study. Children with syndromic clefts, or who have had a previous attempt at cleft correction were excluded. Children with a history of exuberant scar formation following surgery or whose cleft lip repair broke down were also excluded.

Measurement of nostril height, nostril width and alar base width were done in the operating room by a single investigator after general anaesthesia preoperatively and at one week and three months

following surgical repair. These measurements were done using a digital caliper. The parameters that were measured included:

1. Nostril width (NOW): measured from the medial cruz of the alar base to the columella for the cleft and non-cleft sides.
2. Nostril height (NOH): height of the nostril at ½ the nostril width on the cleft and non-cleft sides.
3. Alar base width (ABW): measured from the medial to the lateral cruz of the alar base on the cleft and non-cleft side.

The surgeries were done by oral and maxillofacial surgeons that are experienced in cleft lip and palate surgery (the surgeons have been involved in cleft lip repair for not less than five years and have done a minimum of 50 cleft lip repair). The surgeons were allowed to use techniques which they are comfortable with and believed to achieve the best results based on the severity of the cleft. These include; Straight line, Millard and Tennison Randal techniques. Every technique involved preoperative markings, skin incisions and cuts which were made in accordance with technique of choice.

All measured were done with participants laid supine with the intercanthal plane perpendicular to the floor. A head and neck support (size appropriate for children age three months to one year), was used to maintain the head in the desired position. Each parameter was measured three times and recorded and an average of the three measurements were used for data analysis.

Table 1: Demographics

Variable	Frequency	Percentages
AGE		
3months.	23	54.8
4months.	14	33.3
5months.	3	7.1
6months.	1	2.4
8months.	1	2.4
SEX		
Male.	19	45.2
Female.	23	54.8
CLEFT TYPE		
Cleft lip.	11	26.2
Cleft lip and alveolus.	13	31.0
Cleft lip, alveolus and palate.	18	42.8
TECHNIQUE OF REPAIR		
Millards	40	95.2
Straight line	2	4.8
Tennison Randal	-	-

The repaired sides and the normal sides were compared as a percentage ratio (Amarautanga et al[13]). All data collated was analyzed using the IBM SPSS version 20. Categorical variables are presented as frequencies and percentages while continuous variables as mean with standard deviations. A test of hypothesis was done using the paired t-test.

Results

Forty-two children participated in this study to assess improvement in nasal symmetry in children with repaired unilateral complete cleft lip in Kano. Of the 42 participants, more than half of the participants were females (54.8%) with a female to male ratio of 1.2: 1. Participant's age at the time of lip repair ranged from 3 to 8 months. The majority of lip repairs were performed within 3 to 4 months. Unilateral complete cleft of the lip, alveolus, and palate (42.9%) was the most common type of cleft deformity among the study participants followed by

Table II: Assessment of preoperative and postoperative nasal symmetry in unilateral complete cleft lip with/without palate

Test Subjects	Nostril height (mean, sd)	Nostril width (mean, sd)	Alar base width (mean, sd)
Preoperative	86.21 (2.21)	152.41 (6.42)	100.54 (1.28)
One week postop	91.48(1.66)	115.34(2.70)	98.54(1.35)
p value	0.03	*0.000	0.218
Preoperative	86.21 (2.21)	152.41 (6.42)	100.54(1.28)
Three months postop	88.14(1.95)	113.98(2.60)	100.73(0.61)
p value	0.331	*0.000	0.875

Table III: Relationship between the type of cleft and the postoperative nasal symmetry

Test Subjects	Nostril height (mean, sd)	Nostril width (mean, sd)	Alar base width (mean, sd)
One week postop			
Cleft lip	87.88 (16.63)	128.55 (21.25)	97.48 (15.71)
Cleft lip and alveolus	81.00 (13.80)	133.53 (24.27)	93.32 (13.56)
Cleft lip and palate	80.93 (18.92)	135.92 (33.96)	90.56 (16.61)
f-ratio	0.734	0.307	0.740
p value	0.487	0.737	0.484
Three months postop			
Cleft lip	84.50 (10.41)	127.78 (23.81)	96.58 (6.44)
Cleft lip and alveolus	70.37 (16.89)	129.04 (27.36)	95.14 (8.10)
Cleft lip and palate	69.08 (21.72)	132.05 (28.11)	92.24 (9.20)
f-ratio	4.374	0.092	1.075
p value	*0.019	0.912	0.351

unilateral complete cleft of the lip and alveolus (31%) with the unilateral complete cleft of the lip as the least common (26.2%). Clefts among participants were more common on the left side (61.9%) than the right. Almost all lip repairs were done using the Millard's rotational advancement technique (95.2%) as shown in Table 1.

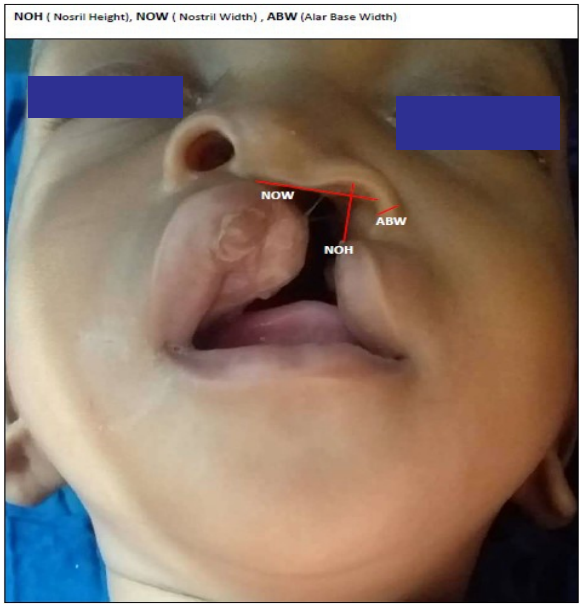

Fig. 1: Pre-operative appearance of participant with unilateral complete cleft lip and palate showing associated abnormalities

Fig. 2: Post-operative picture three months following surgical repair showing asymmetry of the nostril width

Preoperative and postoperative assessment of symmetry

An assessment of the symmetry of the nose preoperatively and postoperatively is as shown in Table II. It showed that only the nostril width had statistically significant asymmetry at one week ($p<0.05$) and three months following surgical repair. An analysis of the postoperative nasal symmetry at one week and three months among the different forms of unilateral complete cleft was done using the one way analysis of variance (ANOVA) as shown in Table III. The post hoc done using the Student-Newman-Keuls test showed that the nostril height of the unilateral complete cleft of the lip and palate was most asymmetrical ($p= 0.019$) among the component forms of unilateral complete cleft.

Discussion

The deformities associated with unilateral complete cleft lip are documented to reflect the differences in linear, area and volumetric dimensions of the nasolabial complex. The aim of surgical repair is to eliminate or reduce these differences to the barest minimum. These differences impact on the symmetry of the face. Facial symmetry is documented to have a great impact on facial attractiveness and the quality of life of the individual.[13] This study evaluated the nose symmetry among cleft subjects both preoperatively and postoperatively.

Anthropometry has been reported to be the best method to evaluate repaired cleft lip and palate morphology because it can quantify the degree of deformity present. This study utilized direct measurements which is rare and very difficult in children younger than one year of age as it is very difficult to obtain their cooperation.[3] The age distribution of participants in our study ranged from three to eight months with majority of cleft repair done at three to four months. This can be attributed to the increased awareness about cleft, most center protocol prescribe lip repair at 3months and the free surgeries provided by Smile Train centers.[14]

Preoperatively, the nose in the child with unilateral complete cleft showed marked asymmetry. The results from this study revealed asymmetry in a child with cleft for the nostril height, nostril width and the alar base width (Fig. 1). The unilateral shortness in the height of the columella, nostril floor

depression from lack of bony support, nasal septal cartilage deviation and flattening of the cleft alar may be responsible for the disproportionate dimensions of the nose.[15,16] This was observed in our study participants as a wide nostril on the cleft side, flattened and deviated nasal tip, flared alar on the cleft side. This presents an aesthetically unpleasant appearance of the nose in the child with cleft.

Postoperatively, there was observed improvement in the nostril height, nostril width and alar base width. Although, a small degree of asymmetry was still observed in nostril height, nostril width and alar base width, this was only significant in the nostril width (Fig. 2). This is because the cartilage and skin of the nose tend to maintain their memory, thus, the tissues of the nose tend to return to their original state while combating the fibrosis from surgical repair.[17] In addition, preoperatively, it was observed that the nostril width was the most asymmetrical among the three dimensions measured. Thus, achieving symmetry intra-operatively required adequate mobilization of the Orbicularis Oris muscle and definitive placement of alar cartilages on the cleft side.[2]

Furthermore, maintaining this symmetry achieved intra-operatively is dependent on the action of the nasal cartilage, scar contracture and the action of the re-attached orbicularis oris muscle.[2,17] This is further worsened where symmetry was not achieved intra-operatively as can be seen by the significant asymmetry observed one week following repair (Table II). Among the three parameters measured, the nostril height and alar base width were relatively symmetrical which was maintained three months following repair. Moreover, balancing between centralizing the columella and restoring symmetrical nostril width using the c-flap in the Millard's rotational advancement technique depends on the skill and the discretion of the surgeon.

Even though the nostril width showed significant asymmetry among study participants, an analysis of the various forms of unilateral complete cleft showed that the asymmetry of the nostril height is most significant in cases of unilateral complete cleft of the lip and palate (Table III). This can be explained by a deficiency of the bony support for the floor of the nose in this subgroup, however, the impact of a small sample size and measurement errors cannot be ruled out. The asymmetry observed was only significant three months following surgery. This can be attributed to healing contracture and invagination of the nasal floor into the alveolar and palatal defect.

The findings from this study supports the need for primary rhinoplasty as a component of primary lip repair.[18] It can be deduced that even a properly done primary lip repair alone may not sufficiently address the problems of the cleft nose. This is because the focus of primary lip repair is on restoring the lip continuity and function in majority of the cases.[19] Correction of the cleft nose deformity is a very challenging task for many cleft surgeons with some surgeons admitting that it is almost impossible to correct.[4] Badr[17] in his 'thug of war' phenomenon described the opposing forces that act in the unilateral cleft nose. Based on which he advocated for a serial repair for better nasal outcomes as simultaneous correction of the nose and lip requires that the lip be elongated in the caudal direction while the nose is lifted in the cranial direction.

In our environment the nose is a prominent feature that is been used to characterise their ethnicity.[8] Although, most parents/caregiver of children with cleft are more concerned about the repair that brings their child to look very close to normal and usually do not bother about minute differences.[20] However, with increasing awareness and influence of social media, it has become imperative that cleft surgeons aim at achieving symmetry of nasal parameters to meet the expectations of parents and children born with cleft.[21]

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Conflict of interest
There are no conflicts of interest.

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