Original Article

COMPARISON OF NASOLABIAL SYMMETRY IN CHILDREN WITH REPAIRED UNILATERAL COMPLETE CLEFT LIP AND NON CLEFT CONTROLS IN KANO, NIGERIA

Authors: Bardi Martins,[1] Adebola Rafel Adetokunbo,[2] Efunkoya Akinwale Adeyemi,[2] Omeje Kelvin Uchenna,[2] Amole Olushola Ibiyinka,[2] Suleiman Abdul Rasheed,[2] Bawa Tsafe Anas.[5]

1. Department of Oral and Maxillofacial Surgery, Aminu Kano Teaching Hospital, Kano & Federal University of Health sciences, Azare, Nigeria.
2. Department of Oral and Maxillofacial Surgery, Bayero University & Aminu Kano Teaching Hospital, Kano, Nigeria.

Corresponding Author: Suleiman Abdul Rasheed**,** Department of Oral and Maxillofacial Surgery, College of health sciences, Bayero University, Kano/Aminu Kano Teaching Hospital campus, Kano. Email: asuleiman.oms@buk.edu.ng Telephone: +2347030776567

ABSTRACT

Context: Assessment of unilateral cleft lip repair is best evaluated by comparing surgical outcomes with matched non-cleft controls from similar ethnoracial backgrounds, as nasolabial appearance varies across populations. This study aimed to compare the nasolabial symmetry of children with repaired unilateral complete cleft lip, with or without palate involvement, to that of matched non-cleft children in Kano.

Setting and Design: A prospective comparative study was conducted among children managed at Aminu Kano Teaching Hospital and the Armed Forces Specialist Hospital, Kano, alongside normal controls, between November 2020 and August 2022.

Materials and Methods: Direct clinical measurements were obtained to assess nasolabial symmetry in children with repaired unilateral complete cleft lip and in matched non-cleft children. Nasal parameters evaluated included nostril width, nostril height, and alar base width. Labial parameters assessed were vertical lip height, vertical philtral height, horizontal lip length, and vermillion height.

Statistical Analysis: Data were analyzed using IBM SPSS version 20, with statistical significance set at $p \leq 0.05$.

Results: Significant differences were observed in all nasal and labial measurements between the cleft and non-cleft groups, both at one week and three months after repair. Only vermillion height showed no statistically significant difference between groups ($p = 0.184$, 0.790).

Conclusion: Despite surgical repair, children with unilateral complete cleft lip in Kano exhibit persistent nasolabial asymmetry when compared with non-cleft peers. Surgeons are encouraged to consider ethnogeographical norms of nasolabial morphology during cleft lip repair to improve aesthetic outcomes.

KEYWORDS: Anthropometry, Nasolabial symmetry, Unilateral complete cleft lip and palate.

INTRODUCTION

Cleft lip is a congenital anomaly that is associated with abnormalities of the lip and nose. [1] These abnormalities pose a serious concern to both the parent and the child. Following surgical correction of the cleft lip, some degree of disability may persist. [2] These residual deformities, whether minor or gross, may impact negatively on facial attractiveness. Unattractive faces are reported to impact on the psychology of the child. [2, 3] This is particularly worrisome as it affects self-esteem, social competence and quality of life. It is becoming increasingly relevant to review the outcome of unilateral complete cleft lip repairs. The goal is to identify deficiencies that promote correction, thus reducing the need for secondary repair. This will ultimately promote self-confidence and improve the quality of life of children born with a cleft.

The region of the face most affected by cleft lip and palate is the nasolabial region. [1] The nasolabial region is also known to show asymmetry when compared with other parts of the face. [4, 5] In addition, the nasolabial region is reported to be of different forms. Different race and ethnic groups are characterized by different facial forms resulting from the interplay of genetic and environmental factors.

The interplay of genes and environment determines the shape of the nose and lip of

individuals from different ethnic groups and races. The impact are seen in the length, width, volume, projection of the different aspects of the lip and nose.[6] In Nigeria, there are more than 250 ethnic groups who share similarities in culture, environment and ancestry, however, a study comparing facial forms among the Hausa and Yoruba ethnic groups found that although, both share similar platyrrhine (broad) noses, they found significant differences in the dimensions of the nose in both ethnic groups.[7, 8] These dimensions have become important reference data for surgical planning and corrections of defects affecting these parts of the face.

Thus, achieving symmetry in these dimensions within ranges acceptable for a population is important in retaining the identity and values of a set population. [6, 9] Outcome assessment of surgical repair of cleft lip and palate should therefore, consider the nose and lip form of the children in that environment. It is better to assess the outcome of unilateral complete cleft lip repair by evaluating the symmetry of the nasolabial area and comparing it to that obtained in non-cleft children of similar age and sex of same environment.

The aim of this paper is to compare nasolabial parameters between children with repaired unilateral complete cleft lip and matched non-cleft children in Kano using the symmetry of anthropometric measurements.

MATERIALS AND METHODS

This was a prospective comparative study carried out from November, 2020 to October, 2022 at the Oral and Maxillofacial Surgery clinics of two hospitals. The hospitals are the Aminu Kano Teaching Hospital (AKTH), and the Armed Forces Specialist Hospital (AFSH), both located in Kano, Nigeria. 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 (**AKTH/MAC/SUB/12A/P-3/VI/2988, NHREC/17/03/2018**).

The inclusion criteria for the study group were children with unilateral complete cleft lip with or without palate planned for cleft lip repair. The control group consisted of children with no facial deformity and no history of previous surgery, injuries or scarifications in the nasolabial region. All children were within the age bracket of 3 months to 1 year. Informed consent was obtained from parents of children who participated in the study. Children with syndromic clefts, a history of exuberant scar formation following surgery and cleft lip repair that broke down, were all excluded.

The sample size was determined with the aid of the formula for comparative research studies. [10] $N = (Z_\alpha + Z_{1-\beta})^2 (\sigma_1 - \sigma_2) / (U_1 - U_2)^2$. Probability that the two groups differ (Z_α) reflects a true difference in the two populations otherwise known as confidence interval was set at 95% with the power of the study ($Z_{1-\beta}$), that is the probability that if the two populations differ, the samples would show significant differences was set at 80%. The anthropometric data from a similar study which reported the philtral height of the study group had a mean outcome of 12.19mm with a standard deviation of 2.36mm and the control group had a mean outcome of 11.82mm with a standard deviation of 1.71mm [11] accommodating a 10% attrition rate was used, this brought the sample size to 42 participants each in both groups.

The surgeries were done by cleft surgeons who have been involved in cleft lip repair for five years or more and have done a minimum of 50 cleft lip repair. The surgeons were allowed to use techniques they are comfortable with and believed to achieve the best results based on their experience. Assessment for symmetry of nasal and lip parameters were done at one week and three months after surgical repair. This was to assess the nose and lip parameters following removal of sutures as well as the impact of healing on the outcome. All measurements were done by the principal investigator (ICC intra-observer reliability of 0.981 at 95% CI).

All measurements were done while participants were asleep in a supine position with the intercanthal plane perpendicular to the floor. A head and neck support (size appropriate for children age 3 months to 1 year) was used to maintain the head in the desired position. Direct measurements of nasal and lip parameters were done using an electronic digital caliper (FERVI C031/150 stainless steel electronic digital calliper). Each parameter was measured 3 times and recorded, and an average of the 3 measurements was calculated. Only the average values were used for data analysis.

Points used to map out these parameters (**Fig. 1**) were marked in the child with a cleft and control. All parameters as outlined in (**Table I, Fig. 2 & 3**) were assessed individually for nostril and lip symmetry. The repaired sides and the normal sides were compared as a percentage ratio (Amaratunga et al [12]) in the cleft group. Also, both sides of the non-cleft control were compared as a percentage ratio. Perfect symmetry is represented by 100, while deviation in symmetry is represented by a measurement greater or less than 100. These ratios were used to calculate the mean and standard deviations from normal.

Data was collated and analysed using the IBM SPSS (Statistical Package for social sciences) Statistics version 20 statistical software. Data management and data validation was done. Categorical variables is presented as frequencies and percentages while continuous variables is presented as mean and standard deviation where normally distributed or median and interquartile range if not normally distributed. The independent sample t-test was used to determine the statistically significant difference between means with level of statistical significance set at $p<0.05$, $CI = 95\%$. While a smaller t-value indicates that similarity exist, a larger t-value indicates differences between groups. The one-way analysis of variance (ANOVA) with the Student-Newman-Keuls post hoc test was also used to determine any statistically significant differences between the means among cleft groups.

RESULTS

Eighty-four children were recruited into this study with 42 participants in the study group and 42 age and sex matched participants in the control group. Of the 42 participants in each group, more than half of the participants were females (54.8%) with a female to male ratio of 1.2: 1. Participants' age at the time of lip repair ranged from 3 to 8 months. The majority of the lip repairs were performed within 3 to 4 months (88.1%). Unilateral complete cleft of the lip, alveolus and palate (42.9%) was the most common type of cleft deformity among the study participants with majority occurring on the left. Almost all lip repairs were done using the Millard's rotational advancement technique (**Table II**).

Table 1: Definition of nasal and lip parameters.

S/N	Parameter	Definition
1.	Nostril width (NOW)	This was measured from the medial cruz of the alar base to the columella for the non-cleft side. It was measured from the medial cruz of the alar base to the columella for the cleft side.
2.	Nostril height (NOH)	This is the height of the nostril at ½ the nostril width on the non-cleft side. It was measured as the height of the nostril at ½ the nostril width on the cleft side.

3.	Alar base width (ABW)	This was measured from the medial to the lateral cruz of the alar base on the non-cleft side. It was measured from the medial to the lateral cruz of the alar base on the cleft side.
4.	Vertical philtral height (VPH)	This was measured from the peak of Cupid's bow to the midpoint of the columella on the non-cleft sides. It was measured from the peak of Cupid's bow to the midpoint of the columella on the cleft side.
5.	Vertical lip height (VLH)	This was measured from the alar base to the peak of Cupid's bow on the same side. It was measured from the alar base on the cleft side to a point where the white roll begins to disappear.
6.	Horizontal lip length (HLL)	This was measured from peak of Cupid's bow on the non-cleft side to the ipsilateral commissure of the mouth. It was measured from where the white roll starts to fade out to the ipsilateral commissure.
7.	Height of vermillon (HOV)	This was measured from the peak of the Cupid's bow on the non-cleft side to a line joining the commissures. It was measured from the peak of the Cupid's bow on the cleft side to a line joining the commissures.

Table 2: Demographics.

VARIABLES	CLEFT SUBJECT (FREQ, %)	CONTROL SUBJECTS (FREQ, %)
AGE (MONTHS)		
3	23 (54.8)	23 (54.8)
4	14 (33.3)	14 (33.3)
5	3 (7.1)	3 (7.1)
6	1 (2.4)	1 (2.4)
8	1 (2.4)	1 (2.4)
		p value = 1.00
SEX		
Male	19 (45.2)	19 (45.2)
Female	23 (54.8)	23 (54.8)
TYPE OF CLEFT		NIL
Cleft lip	11 (26.2)	
Cleft lip and alveolus	13 (31.0)	
Cleft lip, alveolus and palate	18 (42.9)	
SIDE OF CLEFT		NIL
Right	16 (38.1)	
Left	26 (61.9)	
TECHNIQUE OF REPAIR		NIL
MILLARDS	40(95.2)	
STRAIGHT LINE	2(4.8)	

Table 3: Comparison of nasal and lip symmetry between study group (children with repaired unilateral complete cleft lip) and non-cleft control at one week postop.

Assessment	Nostril height. Mean ±SD	Nostril width. Mean ±SD	Alar base width. Mean ±SD	Vertical philtral height. Mean ±SD	Vertical lip height. Mean ±SD	Horizontal lip length. Mean ±SD	Height of vermillion Mean ±SD
Study group (%)	82.78 (16.14)	132.02 (25.52)	94.38 (15.23)	106.44 (13.86)	97.04 (17.30)	94.04 (10.60)	96.72 (18.73)
Control (%)	100.18 (7.12)	98.66 (4.25)	102.69 (6.67)	98.30 (3.73)	100.74 (3.61)	101.52 (3.10)	100.78 (5.89)
t value	6.393	9.283	3.241	3.675	1.358	4.390	1.340
p value	*0.001	*0.001	*0.002	*0.001	0.178	*0.001	0.184

statistically significant with p-value set at <0.05. SD = standard deviation, t = independent t-test.

Table 4: Comparison of nasal and lip symmetry between study group (children with repaired unilateral complete cleft lip) and non-cleft control at three months postop.

Assessment	Nostril height. Mean ±SD	Nostril width. Mean ±SD	Alar base width. Mean ±SD	Vertical philtral height. Mean ±SD	Vertical lip height. Mean ±SD	Horizontal lip length. Mean ±SD	Height of vermillion Mean ±SD
One week postop							
Study group (%)	76.09 (17.27)	129.29 (25.50)	98.76 (3.45)	106.16 (9.98)	87.50 (11.66)	96.05 (8.85)	101.20 (8.25)
Control (%)	100.18 (7.12)	98.66 (4.25)	102.69 (6.67)	98.30 (3.73)	100.74 (3.61)	101.52 (3.10)	100.78 (5.89)
t value	8.361	7.679	3.452	4.780	3.320	3.782	0.267
p value	*0.001	*0.001	*0.001	*0.001	*0.001	*0.001	0.790

statistically significant with p-value set at <0.05. SD = standard deviation, t = t-test.

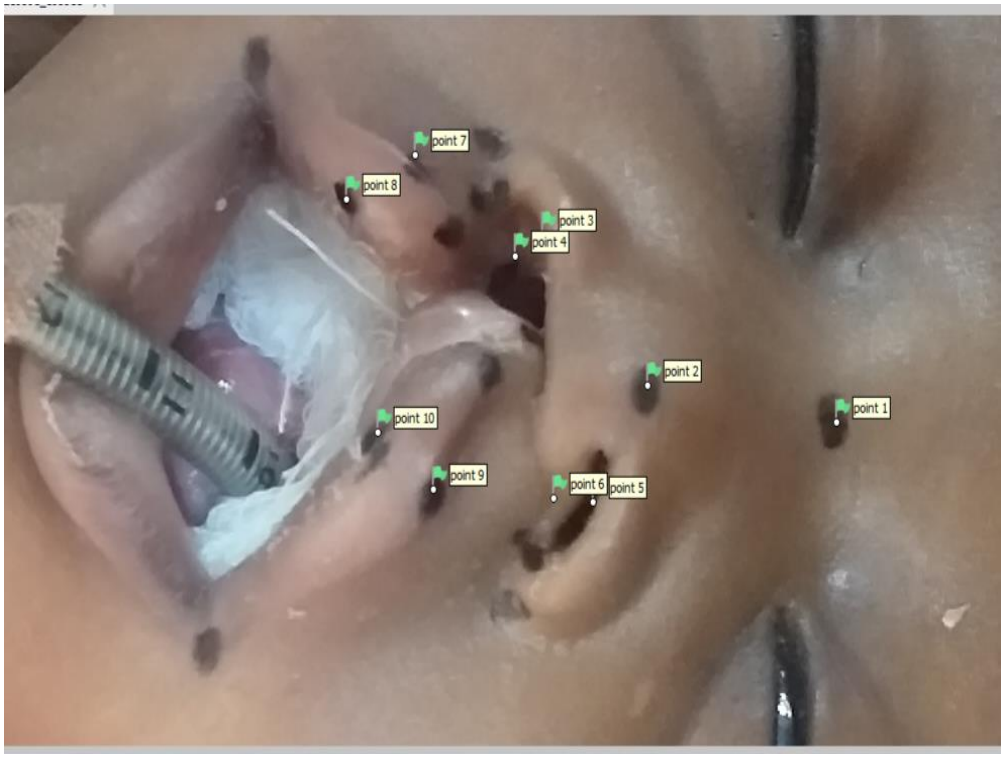

Figure 1: Points used to map out parameters

Figure 2: Picture of study participant with markings of lip parameters

Fifure 3: Picture of control with markings of nasal parameters

Comparison of nasal and lip symmetry between study and control group using the independent sample t-test at one week following surgical repair (**Table III**) showed significant difference in the nostril height (p<0.001), nostril width (p<0.001) and alar base width (p=0.002) in the study group when compared with control. The difference in the lip was also significant for the vertical philtral height (p<0.001) and the horizontal lip length (p<0.001) one week following surgical repair. An analysis of the nose and lip three months after surgery using the independent sample t-test (**Table IV)** showed that the difference in the nostril height (p<0.001), nostril width (p<0.001) and alar base width (p<0.001) remained significant in the study group when compared with control. The difference in the lip was also significant for the vertical philtral height (p<0.001), horizontal lip length (p<0.001) and the vertical lip height (p<0.001).

The vertical lip height (p = 0.178) and the height of vermillion (p = 0.184) were similar to the control one week following surgical repair with only the height of vermillion (p = 0.790) maintaining similar symmetry as the control three months after surgical repair.

The relationship between the postoperative symmetry and the side where the cleft is located was analysed using the independent sample t-test revealed no statistically significant difference in all anthropometric parameters in relation the side of the cleft as shown in **Table V**. An analysis of the postoperative nasal and lip symmetry at three months among the different forms of unilateral complete cleft was done using the one way analysis of variance (ANOVA) as shown in **Table VI**. The post hoc done using the Student-Newman-Keuls test showed that the difference lies between the unilateral complete cleft lip and palate and other forms of unilateral complete cleft for vertical lip height and nostril height.

DISCUSSION

An assessment of the outcome of any surgical procedure is pivotal to its improvement. Surgical correction of cleft lip and palate defect has gained international recognition and various methods have been adopted to assess and improve its outcome. [13-15] An improvement in the outcome can only be assessed where baseline data is available for comparison. It is generally believed that surgical correction of cleft lip restores the aesthetic appearance of the child but the extent to which a child with the repaired cleft looks like that of a non-cleft child of similar age and sex in this environment is yet to be exhaustively documented.

The results of this study showed that the child without cleft in this environment do not have perfect symmetry of the nose and lip. The nose of the child without cleft in this study showed asymmetry in the nostril width and alar base width. The nostril width on the left side was wider when compared to that of the right side. In contrast to the wider nostril width on the left in the child without a cleft, the right nostril had a larger alar base width compared to the left side. These findings supports the fact that there is some degree of directional asymmetry in humans evidenced by the asymmetry in the nose of the child without a cleft. [2]

In the child with unilateral complete cleft lip following repair, the nose was asymmetrical as regards the nostril height, nostril width and alar base width. Similar findings have been reported by previous studies.[2, 16, 17] The nostril height on the cleft side observed in this study was lesser than that of the non-cleft side, indicating a proportional challenge at establishing a normal nostril height and consequently restoring the dome of the nostril on the cleft side. Concerning the nostril width, the cleft side was found to be wider when compared to the non-cleft side after repair. This in addition to the flattened dome, gives the nostril observed in the child with unilateral complete cleft lip a relatively unaesthetic appearance even after surgical repair.

Although, achieving nasal symmetry has been reported to be very challenging to most cleft surgeons, it is recommended that the surgical repair of unilateral complete cleft should also focus considerably on achieving nasal symmetry intraoperative. The child with unilateral complete cleft lip differ considerably in the nose form when compared to the child without cleft in Kano. This difference for children in this environment is more marked in the nostril height as the child without cleft show slight asymmetry in their nostril width and alar base width. This was observed one week after the surgery and maintained even after three months.

This may be explained by the fact that the cartilage and skin of the nose tend to retain their memory, thus, the tissues of the nose tend to return to their original form following healing especially if purposeful attempts were not made intraoperative to reposition these nasal tissues. [18] Also, most of the lip repair done in this study did not incorporate any form of primary rhinoplasty which might have contributed to the lack of symmetry in all nasal parameters seen as early as one week postoperative.

The lip in this study showed that the child without cleft has asymmetry in their vertical philtral height and their horizontal lip length. While the vertical philtral height was longer on the left side, the horizontal lip length was longer on the right side. In addition to the vertical philtral height and horizontal lip length asymmetries, the child with unilateral complete cleft lip on the other hand showed asymmetry in the vertical lip height three months postoperative. The cleft sides were shorter in terms of the vertical lip height and horizontal lip length. Only the vertical philtral height was longer on the cleft side.

However, it was observed that the height of vermillion was statistically similar in both groups at three months postoperative. Thus, comparing the nasolabial symmetry in the child with repaired unilateral complete cleft lip and the child without a cleft showed that they differ significantly in all parameters except for the height of vermilion after three months. This conforms to findings reported by Adenwallan and Narayanan [19] and Duffy et al. [20] This study's results support the conclusion made by Duffy et al [20] regarding the existence of significant differences between the facial surface morphology of children with unilateral complete cleft lip and children without cleft.

An analysis of the postoperative nasal and lip symmetry at three months among the different forms of unilateral complete cleft revealed that a significant difference lies between a child with cleft lip and palate, and other forms of cleft for vertical lip height ($p = 0.015$) and nostril height ($p = 0.019$). This means that the children with unilateral complete cleft lip and palate had more asymmetry when compared with children with unilateral complete cleft lip or unilateral complete cleft lip and alveolus. This is attributed to the severity of the defect, as children with unilateral complete cleft of the lip and palate tend to present with a wider defect and a more complex morphology. In addition, the children with unilateral complete cleft lip and palate constituted the majority of the study group.

The rule of 10 is universally applied in identifying the readiness of a child with cleft for surgical repair. Here, the weight of at least 10pounds, a hemoglobin concentration of at least 10g/dl with the child not younger than 10weeks of age make up the rule of 10. This does not directly give an indication of the amount nose and lip development and how this can impact the symmetry of the nasolabial region. [21] In addition, the nasolabial region of the face is reported to be plaqued with directional asymmetry in most

population.[5] This is worsened by the fact that the non-cleft side may not suffice as reference for the correction of the cleft side. Thus, surgeons needs to familiarize themselves with the anthropometry of the nose and lip for children in that environment. This study has contributed to providing data of children in Kano.

This study has not only provided data on the lip and nose dimension of children within that age group in the northern Nigerian population but has also shown nose and lip dimensions that the surgeon should strive to achieve symmetry in order to attain satisfactory repair outcomes. This is especially important in cases of unilateral complete cleft lip and palate as they present with worse severity and pose more difficulty at repair. Surgical repair of the unilateral complete cleft lip should aim at achieving symmetry in the nose and lip with high consideration of the nostril height and vertical lip height.

This in addition to the symmetry of the height of vermilion, will make the child with a repaired unilateral complete cleft lip look like the child without cleft. The incorporation of primary rhinoplasty during primary lip repair may improve the nasal symmetry and the outcome of unilateral complete cleft lip repair. Cleft surgeons may benefit from training and retraining on primary rhinoplasty techniques. A secondary lip repair in addition to secondary rhinoplasty may be required to achieve nose and lip symmetry in children with a unilateral complete cleft lip.

Conclusively, though symmetrical differences occur in the lip and nose of a non-cleft child within non-perceivable ranges, the nasolabial symmetry of the child with unilateral complete cleft lip after primary repair differs considerably from that seen in the non-cleft child. It is recommended that cleft surgeons should consider the nasolabial anthropometry of a non-cleft child in the affected child's environment and pay attention not only to the restoration of the lip symmetry but also to the restoration of the nasal symmetry through primary rhinoplasty procedures to improve surgical outcome of repairs.

LIMITATIONS OF THE STUDY.

Although the cleft surgeons involved in this study were standardised using experience and level of specialization, multiple surgeons were involved in the study. The level of skill and mastering of the repair techniques may impact the outcome of these surgeries. In addition, this study focused on the symmetry achieved following primary repair and the impact of healing on nose and lip outcomes, a longer period of evaluation beyond three months

may provide more information on the impact of growth and development on the symmetry of the nose and lip of the child with repaired unilateral complete cleft lip. The majority of techniques used in this study was the millard's rotational advancement technique while the percentage of straight technique used was insignificant however, the technique used based on the severity of the cleft may also impact the outcome of surgical repair.

Financial support and sponsorship.

Nil.

Conflicts of interest.

There are no conflicts of interest.

Acknowledgement.

The authors would like to express their gratitude to the National Surgical, Obstetrics, and Anaesthesia Plan for Nigeria (NSOAPN) for all of their contributions in developing the manuscript.

REFERENCES.

1. Carroll K, Mossey PA. Anatomical Variations in Clefts of the Lip with or without Cleft Palate. Plastic Surgery International. 2012; 2012: 6p.
2. Adeyemo WL, James O, Butali A. Cleft lip and palate: Parental experiences of stigma, discrimination and social/structural inequalities. Ann Maxillofac Surg 2016; 6: 195-203.
3. Eichenberger M, Staudt CB, Pandis N, Gnoinski W, Eliades T. Facial attractiveness of patients with unilateral cleft lip and palate and of controls assessed by laypersons and professionals. Eur J Orthod. 2014; 36(3): 284-289.
4. TheFreeDictionary.com. 2020. Definition of Nasolabial Region. [online] Available at: https://medical-dictionary.thefreedictionary.com/definition of nasolabial region [Accessed 26 September 2020].
5. Ahmad Y, Starbuck JM. Disruption of symmetry: A quantitative assessment of facial skeleton anatomy in children born with unilateral cleft lip and palate. Clin Anat 2018; 31: 1129-1136.
6. Djordjevic J, Zhurov AI, Richmond S, Cai T. Genetic and environmental

contributions to facial morphological variation: A 3D population based twin study. PLOS ONE. 2016; 11 (9): e0162250. https://doi.org/10.1371/journal.pone.0162250.

7. Ogbaji J. O. An Assessment of Traditions of Origin of some Ethnic Groups in Nigeria in Kaduna Journal of Historical Studies, Vol. 7, 2015, 170-186.
8. Anas IY, Saleh MS. Anthropometric Comparison of Nasal Indices between Hausa and Yoruba Ethnic Groups in Nigeria. Journal of Scientific Research and Reports. 2014; 3:437-444.
9. Mohammed I, Mokhtari T, Ijaz S, Ngaski AA, Akanji Omotosho D, Milanifard M, et al. anthropometric study of nasal index in Hausa ethnic population of northwestern Nigeria. J Contemp Med Sci. 2018; 4: 26-29.
10. Singh A, Masuku M. Sampling techniques and determination of sample size in applied statistics research: an overview. International Journal of Economics, Commerce and Management. 2014; 2: 1-22.
11. Adetayo AM, James O, Adeyemo WL, Ogunlewe MO, Butali A. Unilateral Cleft Lip Repair: A Comparison Of Treatment Outcome With Two Surgical Techniques Using Quantitative (Anthropometry) Assessment, J Korean Assoc Oral Maxillofac Surg 2018, 44:3-11.
12. Amaratunga S. Comparison of Millard's and LeMesurier's method of repair of the complete unilateral cleft lip using a new symmetry index. J Oral Maxillofac Surg 1988; 46:353-356.
13. Deshmukh M, Vaidya S, Deshpande G, et al. Comparative evaluation of esthetic outcomes in unilateral cleft lip repair between the Mohler and Fisher repair technique: a propective, randomized, observer-blind study.

Journal of Oral and Maxillofacial Surgery. 2019; 77: 182.e1- 182.e8.

14. Bagante I, Zepa I, Akota I. 3D assessment of nasolabial appearance in patients with complete unilateral cleft lip and palate. Cleft Palate Craniofac J. 2018; 55: 220-225.
15. Pietruski P, Majak M, Debski T, Antoszewski B. A novel computer system for the evaluation of nasolabial morphology, symmetry and aesthetics after cleft lip and palate treatment. Part 2: Comparative anthropometric analysis of patients with repaired unilateral complete cleft lip and palate and healthy individuals. J Craniomaxillofac Surg. 2017; 45: 505-514.
16. Adetayo AM, Adetayo MO, Funmi AO, Somoya MS, Adeyemi MO, Adeyemo WL. Comparison of professional and laypeople evaluation of nasolabial esthetics following unilateral cleft lip repair. Eur J Dent 2018; 12: 516-522.
17. Freeman AK, Mercer NS, Roberts LM. Nasal asymmetry in unilateral cleft lip and palate. J Plast Reconstr Aesthet Surg. 2013; 66: 506-512.
18. Abdulrauf BMI. Cleft rhinoplasty: A tug of war. Plast Reconstr Surg Glob Open. 2021; 9: 3839.
19. Adenwalla HS, Narayanan PV. Primary unilateral cleft lip repair. Indian J Plast Surg. 2009; 42: 62-70.
20. Duffy S, Noar JH, Evans RD, Sanders R. Three-dimensional analysis of the child cleft face. Cleft Palate Craniofac J. 2000; 37: 137-144.
21. Pendem S, Bhuvan Chandra R, Selvarasu K, Krishnan M, M R M, J P. Analysis of Different Facets of the Rule of 10 for Cleft Lip Repair for Their Application in the Current Era. Cureus. 2024; 16(2): e53832.