Research Article

Comparison of various nasal parameters in different anteroposterior jaw relationships and growth patterns

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ABSTRACT

Introduction: Evaluation of the patient soft tissue is one of the most important considerations in the diagnosis and customized treatment plan to enhance the facial esthetics of the patient. Hence, the present study was conducted to evaluate the nasal parameters in different anteroposterior jaw dysplasia and its association with different growth patterns and any gender dimorphism.

Materials and Method: This study was conducted at the Chitwan Medical College in the Department of Orthodontics. Lateral Cephalogram of 100 patients with age ranging from 18-27 years were collected and traced manually. Various nasal parameters were then measured and descriptive statistics were performed followed by ANOVA tests to find out any statistical differences.

Result: Among 100 subjects, 48 had average growth pattern, 26 had horizontal pattern, and 26 had vertical pattern. Likewise, 41 samples had skeletal class I, 39 had skeletal class II, and 20 had skeletal class III relationship. Nose length was greater in vertical growth pattern and skeletal class I. Nasolabial angle was greater in vertical growth pattern and skeletal class II. Nasal depth was greater in horizontal growth pattern and skeletal class II. Lower nose to Frankfurt horizontal angle was greater in average growth pattern and skeletal class III. All the parameters showed greater value in males with no statistically significant difference between gender.

Conclusion: The present study showed that although different parameters showed variation among different malocclusions and growth pattern but it was not statistically significant.

KEYWORDS: Cephalometric, Growth pattern, Nasal, Soft tissue

INTRODUCTION

Facial harmony is largely influenced by the nasal morphology. For decades, Orthodontists have attempted to objectively grasp the true meaning of facial beauty. Some consider the nose to be the keystone of facial aesthetics since it is such a conspicuous aspect of the human face.[1] As the nose dominates the middle part of the face, the degree of facial esthetics is greatly influenced by it.

With growth, changes take place in the dimension of the soft tissue covering the bony profile. These changes can have some effect on the configuration of the facial profile. Subtelny reported that the soft tissue nose continues to grow in a downward and forward direction from 1 to 18 years of age i.e., by the age of 16 years in girls and 18 years in boys. The disproportionate rate of growth of the nose explains the finding that the total soft tissue profile increases in convexity with increment in age.[2] The ideal nasal proportion includes a straight nasal dorsum, with the nasal-tip cartilage and dorsal cartilage above the nasal tip creating the supratip break

and the alar rims 1 to 2 mm superior to the columella when observed in a lateral view.[3]

Chaconas reported that Angle Class II adults have a more pronounced nasal bridge compared to Class I malocclusion adults. However, there was a concave configuration of the nose along the dorsum in Class III adults.[4] In a study done in Nepalese population, Chaudhary et al. found that nasolabial angle was larger in case of Class II when compared to Class I and Class III. Similarly, both nasal length and nasal height measurements were in the order of Class III > Class II > Class I.[5]

Considering the ethnic and racial difference in Nepalese population to other reported population groups, it has become imperative to assess nose morphology in Nepalese population. Hence, the present study was conducted to evaluate the nasal parameters in different anteroposterior jaw dysplasia and growth patterns and to find out about any gender dimorphism.

MATERIALS AND METHOD

Lateral cephalograms of patients were taken from the archives of the Department of Orthodontics and Dentofacial Orthopedics at Chitwan Medical College between the time frame of January, 2021 to January, 2023. Ethical clearance was obtained from the Institutional review committee of Chitwan Medical College (CMC-IRC/079/080-227).

Sample size was calculated using the formula:

$$\text{Sample size} = \frac{z^2\sigma^2}{e^2}$$

where, Standard deviation (σ) = 1.61 (Bhardwaj A et al.)[6]

Z value (z) = 1.96

Level of precision (e) = 0.322

Sample size = $1.96^2 . 1.61^2 / 0.322^2$

= 96.04

≈ 100

The sample consisted of 100 Nepali adults (37 males and 63 females). Lateral cephalometric radiographs of patients between 18 and 30 years of age with full complement of the permanent teeth were taken as inclusion criteria. Exclusion criteria were radiographs of adults with developmental problems affecting growth and development, adults with a history of trauma and/or surgery affecting face, adults with endocrine disturbances affecting growth and development and eruption of teeth, adults who have undergone orthodontic treatment, and radiograph of adult with abnormal dental conditions including impactions, transposition and congenitally missing teeth, and incomplete records.

All the cephalograms were taken in Natural Head Position (NHP) with a relaxed lip posture with a cephalostat (VATECH, Korea) and Pax image capturing software and were then traced manually on 0.004-inch acetate paper using a 3H pencil. Measurements were then made on a lateral cephalogram using digital vernier caliper, ruler, and protractor. Description of various cephalometric parameters is given in Table 1 and Figure 1.

Table 1: Various cephalometric parameters used in the study

Cephalometric parameters	Description
SNA	Angle between Sella (S) - Nasion (N) plane to Nasion (N) – point A plane
SNB	Angle between Sella (S) - Nasion (N) plane to Nasion (N) – point B plane
ANB	Angle between SNA and SNB
GO-GN to SN	Angle between Sella (S) - Nasion (N) line and Gonion (GO) - Gnathion (Gn) line
Nasal length (N Lth)	The distance between Soft-tissue Nasion (N') and Pronasale (Pr)
Nasal depth (N Dpt)	The perpendicular distance between Pronasale (Pr) and the line drawn through N' to Subnasale (Sn)
Nasolabial angle (NLA)	The angle formed by columella tangent and upper lip tangent
Lower nose to Frankfort plane angle (LNFH)	Inclination of the upper lip to Frankfurt horizontal plane

SNA, SNB, and ANB angle were used to determine the sagittal relationship of the patient. Sagittally, the adults were classified as Class I with ANB = 1–4°, Class II with ANB >4°, and Class III with ANB = 34°). To determine the growth pattern of the adults, GO-GN to SN was used. The adults were grouped into three categories as average growers (GO-GN to SN = 28–34°), horizontal growers (GO-GN to SN = 34°) and vertical growers (GO-GN to SN = >34°).

Four nasal measurements were used to determine the nasal characteristics, which included N Lth, N Dpt, nasolabial angle (NLA), and lower nose to Frankfort horizontal plane angle (LNFH).[7]

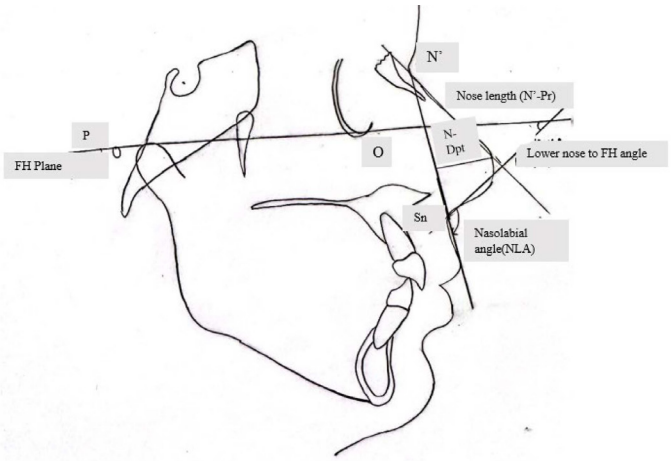

Figure 1. Nasal Parameters

All the data were then entered in excel worksheet and then were analysed using Statistical Package for Social Sciences (SPSS) version 25. Twenty randomly chosen samples were remeasured after two weeks by the same examiner and intraobserver reliability was found out using Intraclass correlation coefficient. Normality of data was checked using Kolmogorov – Smirnov test. Descriptive statistics were then calculated. The group differences in sagittal and vertical relationships among all 100 patient's records were analyzed with one-way analysis of variance (ANOVA). Gender dimorphism was checked using Independent sample t – test.

RESULT

Intraclass correlation coefficient showed excellent reliability of all the variables i.e. 0.9 for N Lth, 0.92 for N Dpt, 0.91 for NLA, and 0.9 for LNFH. Kolmogorov – Smirnov test should normal distribution of variables. Upon evaluation of nasal parameters in different anteroposterior jaw relationships, N lth was found to be greatest in Class I cases. Similarly, NLA and LNFH angle were greatest in Skeletal Class III cases and N Dpt was greatest in Skeletal Class II cases. All the nasal parameters showed statistically non-significant difference between different malocclusion groups. (Table 2)

Table 2: Descriptive statistics and comparison of Nasal parameters in different sagittal skeletal relationships

Nasal parameters	Malocclusion class	No. of samples	Mean ± S.D.	Significance (p<0.05)
N Lth	Class I	41	42.83±3.63	0.9
	Class II	39	42.74±5.06	
	Class III	20	42.30±4.26	
NLA	Class I	41	96.88±9.55	0.09
	Class II	39	99.23±12.48	
	Class III	20	93±13.17	
N Dpt	Class I	41	17.85±2.89	0.14
	Class II	39	19.13±3.9	
	Class III	20	17.45±2.21	
LNFH	Class I	41	39.66±7.92	0.17
	Class II	39	40.62±5.3	
	Class III	20	44±13.53	

*p<0.05 is statistically significant. One way ANOVA. N Lth: Nasal length, N Dpt: Nasal depth, NLA: Nasolabial angle, LNFH: Lower nose to Frankfort plane angle, S.D.: Standard deviation

Similarly, upon evaluation of nasal parameters in different growth patterns, N Lth and NLA showed highest value is vertical growth pattern whereas N Dpt showed highest value in Horizontal growth pattern and LNFH angle showed highest value in Average growth pattern. The differences were statistically non – significant. (Table 3)

Table 3: Descriptive statistics and comparison of Nasal parameters in different growth patterns

Nasal parameters	Growth pattern	No. of samples	Mean±S.D.	Significance (p<0.05)
N Lth	Average	48	42.08±4.67	0.09
	Horizontal	26	42.23±3.43	
	Vertical	26	44.27±4.2	
NLA	Average	48	96.75±12.35	0.24
	Horizontal	26	96.58±9.47	
	Vertical	26	97.96±12.54	
N Dpt	Average	48	17.77±3.34	0.89
	Horizontal	26	19.12±2.98	
	Vertical	26	18.35±3.33	
LNFH	Average	48	41.96±10.47	0.48
	Horizontal	26	40.19±5.66	
	Vertical	26	39.65±7.08	

*p<0.05 is statistically significant. One way ANOVA. N Lth: Nasal length, N Dpt: Nasal depth, NLA: Nasolabial angle, LNFH: Lower nose to Frankfort plane angle, S.D.: Standard deviation

All the parameters were larger in males than females but there was no statistically significant difference between gender. (Table 4)

Table 4: Gender – wise comparison of different Nasal parameters

Nasal parameters	Gender	No. of samples	Mean±S.D.	Significance (p<0.05)
N Lth	Male	37	42.76±5.19	0.9
	Female	63	42.65±3.76	
NLA	Male	37	98.16±10.05	0.45
	Female	63	96.35±12.49	
N Dpt	Male	37	19.05±3.53	0.06
	Female	63	17.81±3.03	
LNFH	Male	37	41.03±7.36	0.91
	Female	63	40.83±9.3	

*p<0.05 is statistically significant. Independent Sample t- test. N Lth: Nasal length, N Dpt: Nasal depth, NLA: Nasolabial angle, LNFH: Lower nose to Frankfort plane angle, S.D.: Standard deviation

DISCUSSION

This retrospective study was carried out on lateral cephalograms of 100 adult patients of the Nepalese population to determine the variation in nasal morphology according to various growth pattern and sagittal skeletal relationships.

A treatment plan should be customized to intensify the facial aesthetics of a patient through careful evaluation of the soft tissue drape. Therefore, in depth knowledge and awareness of soft tissue changes is essential for the Orthodontists for treatment planning, taking into notice the ethnic and racial variation in discrete cohorts.

Among the nasal parameter studied, Nose length showed the highest value for Skeletal Class I and least for Skeletal Class III but the difference was not statistically significant. This finding is similar to the one reported by Jamshed et. al.[8] In contrast, Chaconas postulated that class II subjects could be expected to present with an elevated bridge and class III subjects with a longer nose and greater anteroposterior depth. He found that a long nose was associated with a large mandible.[4] The difference may be due to ethnic and racial variations. Nasolabial angle was highest in skeletal class II followed by skeletal class III. This finding is in partial agreement with the study done by Arshad et al. and Perovic et al.[9,10] They too found greatest NLA for Class II malocclusion followed by Class I and Class III, although the difference found was not statistically significant. Similar findings in Nepalese population were reported by Chaudhary et. al.[5] Meanwhile, Nasal depth showed the highest value for class II subjects and least for class III subjects. Wisth found no significant difference in the nose, soft tissue, or hard tissue, while nasal depth was found to be greater in class II subjects, with greater variability in nasal length which is in agreement with our study.[1] Lower nose to Frankfurt horizontal plane angle revealed greatest value in Skeletal class III and lowest in skeletal class I with no statistically significant difference between them. Fitzgerald et. al. compared three nasolabial parameters i.e. lower border of the nose to Frankfort horizontal plane angle, upper lip to Frankfort horizontal plane angle, and nasolabial angle with skeletal measurements and revealed no significant relationship between the soft tissue profile of the nasolabial region and the underlying skeletal relationships.[7]

Nose length value was greatest in vertical growth pattern in this study with no statistical difference between groups. A study by Nehra et. al. showed that Nasal length was significantly correlated with upper anterior facial height ($r=0.850$, $P<0.001$) and inclination of palatal plane ($r=0.433$, $P<0.001$).[11] Nasolabial angle was also more obtuse for vertical growth pattern with no statistically significant difference between various growth patterns. Similar finding was reported by Bhardwaj et. al.[6] Nasal depth was found to be highest in horizontal growth pattern followed by vertical growth pattern in present study. This finding is in contrast to the findings of Rethi et. al. who reported that the nasal depth is found to be least in class II horizontal malocclusion.[12] The difference might be explained by the different measurement techniques than the one described in the present study. LNFH angle showed highest value in average growth pattern and least value in vertical growth pattern in this study with no statistically significant difference. This finding differs from that of the study done by Khare et al. who found out slight positive correlation between lower gonial angle and nasal morphology in high angle cases in terms of nasal length, nasal depth, upper nasolabial angle and nasal tip angle.[13] Robison et al. stated that the sagittal skeletal pattern was highly significantly correlated with general nasal shape; however, the vertical dimension was not significantly related with the nasal shape. This variation in result may be due to the difference in methodology and study sample in the study design.[14]

The present study also showed increased value of nasal parameters in males than females but the difference was statistically non-significant. Hence, no sexual dimorphism was observed in this study. Similar findings were reported by Bhardwaj A et. al. in Indian population.[6] A study done by Aljabaa in Saudi adults showed that there were statistically significant differences between the Saudi males and females in the nasal length, nasolabial angle, horizontal distance from the nose tip to the incisal edge of the most prominent upper central incisor, and chin.[15] These results suggest that both gender and ethnicity must be taken into account when establishing normal values for the nasal form and its relationship to the other cranial structures.

The value of the current study lies in the fact that it provides nasal norms that can be used as a reference during the diagnosis and treatment planning of patients undergoing orthodontic treatment, orthognathic surgery, and rhinoplasty, thus improving the posttreatment results. The limitation of the present study is that the sample size is small and hence, the results cannot be extrapolated for whole Nepalese population. Future studies with larger samples of both genders should be considered.

CONCLUSION

All the nasal parameters showed statistically non-significant differences between different sagittal skeletal relationships and growth patterns. No gender dimorphism was observed as well.

Conflicts of interest: There are no conflicts of interest.

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