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A CROSS SECTIONAL LATERAL CEPHALOMETRIC STUDY TO INVESTIGATE GENDER DIFFERENCES FOR NASAL PROPORTIONS

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ABSTRACT

An esthetically pleasant well balanced human face has been aptly divided into three equal vertical proportions, as the middle one third is filled principally by the nose, it becomes more prominent and the lower one third needs to be balanced with it. The nose, combined with the lips and chin influences the overall facial harmony as they form part of the soft tissue analysis. So, the present cross sectional study aims to investigate gender differences in nasal proportions with different growth patterns in gujarati adults. The sample consisted equal number of adult (18-25 years) males and females (n=30 in each group) with different growth patterns based on jarabak's ratio. Soft copy of Conventional 2D lateral cephalogram was processed in adobe photoshop software cs3 version 10.0 for assessment of nasal proportions. Statistical analysis by Independent t test revealed that Males had more and highly significant ($p<0.001$)difference for nasal length, nasal depth 2, lower dorsum and columella convexity , total facial convexity with nasal tip in all growth patterns. Whereas nasal length in average and horizontal and nasolabial angle in average and vertical growth pattern. Sexual dimorphism was found for nasal proportions Males had long prominent nose in all growth pattern but straight in average, with hump in horizontal and convex in vertical growth pattern.

Keywords-Growth pattern, nasal proportions, lateral cephalogram

INTRODUCTION

Evaluation of the patient's soft tissue is one of the most important components of orthodontic diagnosis and treatment planning. Morphologic relationships and proportions of the nose, lips, and chin determine facial harmony. The balance among these three anatomic structures can be altered by both growth and orthodontic treatment. So it is essential for the orthodontist to have an understanding of these changes incident on treatment as well as the amount and direction of growth expected in the facial structures. The form of the nose and its inclination has an impact on influencing the measurements recorded. The decision to treat orthodontic patients by extraction or non-extraction method and skeletal aesthetic surgeries has an impact of either improving or deteriorating profile. Traditional cephalometrics provides diagnostic information regarding skeletal, dental and soft-tissue analysis in sagittal, vertical, and transverse plane. A cross sectional study is carried out to assess nasal proportions by various linear and angular measurements in untreated adult male and female subjects with different growth patterns [horizontal, average, vertical] as determined by jarabak's ratio from lateral cephalogram.

MATERIAL AND METHODS-

The present cross sectional study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, Government Dental College & Hospital, Ahmedabad. It was approved by the ethical committee. Total 180 gujarati subjects with equal numbers of male (n=30) and female (n=30) were selected to classify the sample in different growth patterns which was defined by Jarabak's ratio [posterior facial height/ anterior facial height] in Average(=**62-65%) ,** Horizontal **(>65%),** and Vertical(**<62%)** growth pattern. For all the subjects, standardized lateral cephalogram was taken in centric occlusion and Natural Head Position (NHP).

Soft copy of Conventional 2D lateral cephalogram was processed in Adobe Photoshop software CS3 version 10.0 and 1:1 true size cephalogram was obtained for cephalometric measurements of nasal proportions.

Following cephalometric landmarks, parameters were used to assess the nose given by ***Vinay V Umale, Kamlesh Singh, Aftab Azam, Madhvi Bhardwaj and Rohit Kulshrestha(2017)[1]***

- **Glabella (G'):** The most prominent soft tissue point of the frontal bone
- **Soft-tissue nasion (N'):** The point of greatest concavity in the midline between the forehead and the nose.
- **Midnasale (Mn)**: The halfway point on nasal length (N'-Pr) that divides the dorsum into upper and lower dorsum.
- **Supratip (St):** The point constructed between mid-nasal and pronasal on the lower third of the nasal dorsum.
- **Pronasale (Pr):** The tip of nose (nasal tip).
- **Columella (Cm):** The most convex point on the columellar-lobular junction.
- **Subnasale (Sn)**: The point at which the columella merges with the upper lip in the mid-sagittal plane.
- **Alar curvature point (Ac):** The most convex point on the nasal alar curvature
- **Labrale superior (Ls):** The point indicating the mucocutaneous border of the upper lip
- **Soft-tissue pogonion (Pg'):** The most anterior point on the chin in the mid-sagittal plane.
- **Superior labial sulcus (SLS):** The point of greatest concavity in the midline of the upper lip between Sn and labrale superius.

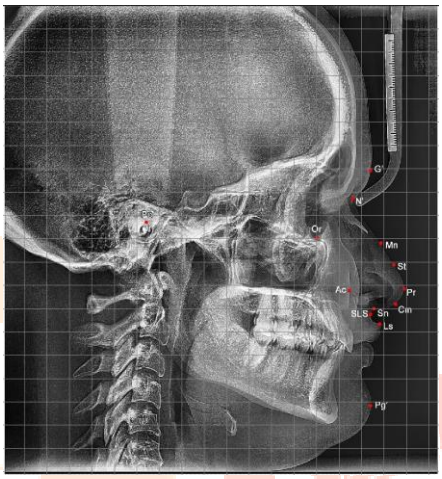

Fig. shows Landmarks of nose on lateral cephalogram

Cephalometric parameters for nasal proportion

1) The axis of dorsum- The line constructed through the depth of the soft tissue nasion to the supratip point
2) Nasal length (N'-Pr)-The distance between N' and Pr,
3) Nasal depth 1- The perpendicular distance between Pr and the line drawn through N' to Sn
4) Nasal depth 2- The distance between points Ac and Pr.
5) Hump- The perpendicular distance between the axis of the dorsum and the most superior point of the upper part of the nasal dorsum
6) Lower dorsum convexity (Dconv)- The perpendicular distance from the most convex point of the lower nasal dorsum to the Mn-Pr line
7) Columella convexity (Cconv)- The perpendicular distance from the most convex point of columella to the line drawn from Pr to Sn.

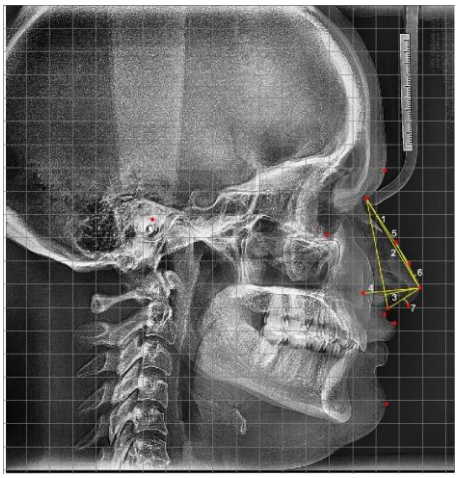

Fig. shows cephalometric measurements on lateral cephalogram.

8) Nasolabial angle (NLA): The angle formed by the intersection of the Cm tangent and the upper lip (Ls)
9) Nasal-base angle (NBA): The inclination of the nasal base (angle between the G'-Sn line and the long axis of the nostril)
10) Nasomental angle (NMA): The angle constructed by the axis of the dorsum and the Pr-to-Pg' line
11) Soft-tissue facial convexity (SFC): The angle between the G'-Sn' line and the Sn'-Pg' line

12)"V"angle: angle between V line and S line.V line is drown through the middle of nose parallel to the true vertical, Steiner's S line extended from the soft tissue contour of chin(pg') to the middle of an S formed by the lower border of the nose at the lips.(new measurement of profile esthetics,Anthony D. viazis, jco 1991).

13) Total facial convexity with nasal tip: angle between the Glabella – pronasale line (G'-Pr) and the pronasale- soft tissue contour of chin line(pr- pog') line.

14)total facial convexity without nasal tip : angle between glabella-superior labial sulcus(G'-SLS) and superior labial sulcus to soft tissue contour of chin(SLS-pog') line.

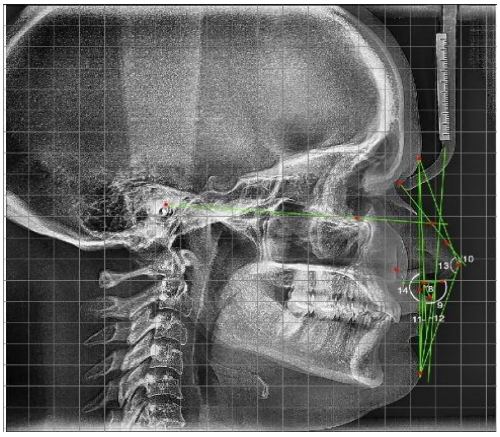

Fig. shows cephalometric measurements on lateral cephalogram

RESULTS AND DISSCUSSION

Data was analysed using SPSS version 23. One way anova test for different growth patterns and Independent t test was done for gender comparision.

Table 1: Comparison of cephalometric measurements between growth pattern- ANOVA test

Parameter	N	Average growth pattern		Horizontal growth pattern		Vertical growth pattern		P value
		Mean	SD	Mean	SD	Mean	SD	
Axis of Dorsum	60	26.62	2.20	27.97	3.88	25.68	2.27	<0.001**
Nasal Length	60	47.18	3.66	41.82	5.44	46.13	5.22	<0.001**
Nasal Depth 1	60	15.82	0.94	18.01	3.63	17.24	1.23	<0.001**
Nasal Depth 2	60	28.71	3.06	27.61	6.20	29.99	2.58	0.010*
Hump	60	0.42	0.35	0.60	0.54	0.52	0.56	0.138 NS
Lower Dorsum convexity	60	1.91	0.38	1.62	0.77	1.62	0.74	0.020*
Collumella convexity	60	2.48	0.40	2.31	0.93	2.16	0.56	0.032*
Nasolabial angle	60	100.92	3.06	102.35	9.49	101.23	4.85	0.439 NS
Nasal Base angle	60	95.74	2.00	87.95	5.33	96.97	2.57	<0.001**
Nasomental angle	60	125.69	1.94	120.89	5.71	118.36	4.85	<0.001**
Soft Tissue convexity	60	17.08	1.30	17.48	5.33	21.40	2.77	<0.001**
V angle	60	14.66	1.96	17.40	3.74	22.35	1.42	<0.001**
Total Facial convexity with nasal tip	60	137.00	4.56	124.71	5.44	120.29	4.77	<0.001**
Total Facial convexity without nasal tip	60	162.53	2.55	155.92	6.93	148.46	5.11	<0.001**

Table 1 shows ANOVA test for comparison of measurements between growth pattern in cephalometric analysis. Axis of dorsum, nasal length, nasal depth 1 is highly significant (p<0.001), nasal depth 2(p<0.010), lower dorsum convexity (p<0.020) and columella convexity (p<0.032) is significant. Hump is not present significantly in any growth pattern. Axis of dorsum is higher in horizontal growth than average and vertical growth pattern. Nasal length is higher in average growth than vertical and horizontal growth pattern. Nasal depth 1 is more in horizontal growth than vertical and average growth pattern. Nasal depth 2 is more in vertical growth than average and horizontal growth pattern. Lower dorsum convexity is more in average growth but equal in horizontal and vertical growth pattern. Columella convexity is more in average growth than horizontal and vertical growth pattern. Nasal base angle, nasomental angle, soft tissue convexity, V angle, total facial convexity with nasal tip, total facial convexity without nasal tip is highly significant(p<0.001).Nasolabial angle is not significant in between growth pattern. Nasal base angle is higher in vertical growth than average and horizontal growth pattern. Nasomental angle is higher in average growth than horizontal and vertical growth pattern.Soft tissue convexity and V angle is higher in vertical than horizontal and average growth pattern**.** Total facial convexity without nasal tip and with nasal tip is higher in average than horizontal and vertical growth pattern.

Tania Arshad et al(2013)[2] observed that horizontal, vertical and average growth patterns had different nasal profiles due to differences in nasal depth 2 and nasolabial angle. **Robinson et al (1986)[9]** concluded that nasal shape followed the underlying skeletal facial pattern very closely in the sagittal dimension, however no association between nasal morphology and vertical maxillary skeletal pattern.

In the present study nasal proportion differences in growth patterns because of nasal length, axis of dorsum, nasal depth 1, lower dorsum convexity, columella convexity and nasal base angle.

Table 2 Comparison of cephalometric measurements between males and females in Average growth pattern

Parameter	N	Male		Female		
		Mean	SD	Mean	SD	P value
Axis of Dorsum	30	26.0200	2.05903	27.2127	2.19945	0.034*
Nasal Length	30	49.2467	3.57112	45.1120	2.39270	<0.001**
Nasal Depth 1	30	15.9100	.94626	15.7200	.94665	0.440 NS
Nasal Depth 2	30	31.1933	1.77607	26.2233	1.77408	<0.001**
Hump	30	.6517	.18122	.1903	.32522	<0.001**
Lower Dorsum convexity	30	2.2563	.10420	1.5667	.17876	<0.001**
collumella convexity	30	2.6590	.30786	2.2967	.39761	<0.001**
Nasolabial angle	30	103.060	1.5197	98.783	2.7082	<0.001**
Nasal Base angle	30	95.443	1.8713	96.030	2.1106	0.259 NS
Nasomental angle	30	125.223	1.2375	126.163	2.3770	0.060 NS
Soft Tissue convexity	30	16.933	.9689	17.220	1.5747	0.399 NS
V angle	30	16.207	1.0748	13.107	1.3001	<0.001**
Total Facial convexity with nasal tip	30	140.977	2.3450	133.020	2.0321	<0.001**
Total Facial convexity without nasal tip	30	161.210	2.0998	163.843	2.2851	<0.001**

Table 2 shows Nasal length, Nasal depth 2, hump, lower dorsum convexity and columella convexity found to be greater in males which is highly significant (p<0.001), whereas Axis of dorsum is significant(p<0.034) but greater in females. Nasal depth 1 has no gender difference. Nasal base angle, Nasomental angle, Soft tissue convexity shows no gender differences. Nasolabial angle, V angle, Total facial convexity with nasal tip is highly significant (p<0.001) and found to be greater in males but Total Facial convexity without nasal tip is greater in females

Table 3: Comparison of cephalometric measurements between males and females in Horizontal growth pattern.

parameter	N	Male		Female		
		Mean	SD	Mean	SD	P value
Axis of Dorsum	30	30.24	2.94	25.70	3.36	<0.001**
Nasal Length	30	45.42	4.22	38.23	3.96	<0.001**
Nasal Depth 1	30	20.47	3.25	15.55	1.93	<0.001**
Nasal Depth 2	30	32.87	4.09	22.35	2.03	<0.001**
Hump	30	0.79	0.59	0.41	0.40	0.006*
Lower Dorsum convexity	30	2.01	0.79	1.23	0.51	<0.001**
collumella convexity	30	2.85	0.92	1.77	0.56	<0.001**
Nasolabial angle	30	103.63	9.99	101.07	8.94	0.299 NS
Nasal Base angle	30	89.05	3.57	86.85	6.52	0.110 NS
Nasomental angle	30	124.49	4.04	117.30	4.83	<0.001**
Soft Tissue convexity	30	21.66	3.42	13.30	3.16	<0.001**
V angle	30	18.99	3.72	15.80	3.06	0.001*
Total Facial convexity with nasal tip	30	126.45	4.05	122.98	6.12	0.012*
Total Facial convexity without nasal tip	30	159.05	3.00	152.79	8.26	<0.001**

Table 3 shows Axis of dorsum, nasal length, nasal depth 1, nasal depth 2, lower dorsum convexity, columella convexity is highly significant ($p<0.001$) and found to be greater in males. Hump is present in males which is significant than females. ($p=0.006$).Nasomental angle, soft tissue convexity, total facial convexity without nasal tip found to be greater in males which is highly significant($p<0.001$). whereas V angle($p\leq0.001$) and Total facial convexity with nasal tip is greater in males but less significant($p \leq 0.012$).No gender differences for Nasolabial angle and nasal base angle.

Table 4: Comparison of cephalometric measurements between males and females in Vertical growth pattern.

Parameter	N	Male		Female		
		Mean	SD	Mean	SD	P value
Axis of Dorsum	30	26.66	1.73	24.70	2.34	<0.001**
Nasal Length	30	48.28	2.99	43.98	6.07	0.001*
Nasal Depth 1	30	18.03	0.74	16.45	1.12	<0.001**
Nasal Depth 2	30	32.05	1.38	27.93	1.70	<0.001**
Hump	30	0.32	0.15	0.72	0.73	0.005*
Lower Dorsum convexity	30	2.33	0.19	0.91	0.19	<0.001**
collumella convexity	30	2.64	0.32	1.67	0.18	<0.001**
Nasolabial angle	30	105.067	2.4377	97.383	3.3763	<0.001**
Nasal Base angle	30	95.753	2.2767	98.193	2.2753	<0.001**
Nasomental angle	30	116.570	5.6320	120.143	3.0902	0.003*
Soft Tissue convexity	30	22.913	3.1152	19.880	1.0678	<0.001**
V angle	30	22.197	1.1397	22.507	1.6652	0.404 NS
Total Facial convexity with nasal tip	30	117.313	2.7699	123.263	4.5148	<0.001**
Total Facial convexity without nasal tip	30	151.433	2.2634	145.490	5.4578	<0.001**

Table 4 shows Axis of dorsum, nasal depth 1, nasal depth 2, lower dorsum convexityand columella convexity is highly significant (p<0.001), found to be greaterin male, nasal length is significant (p=0.001)which is more in males. Nasomental angle is significant(p=0.003) which is greater in female. Nasal base angle, Total facial convexity with nasal tip is highly significant (p<0.001) and greater in females. Nasolabial angle, soft tissue convexity, Total facial convexity without nasal tip is highly significant (p<0.001) but found to be greater in males. No gender difference found for V angle.

Tania Arshad et al in 2013 observed that males and females had significantly different nasal profiles due to differences in nasal length, nasal depth, nasal hump, columella convexity which were higher in males and insignificant differences between males and females for nasolabial angle.

Vinay V Umale et al in 2017[1] observed that Nasal length, nasal depth 2 were significantly higher in class I and also in males (p< 0.001), soft tissue convexity angle was significantly higher in class I and also in males(p<0.001).

Ayse Gulsen et al [21] observed statistically significant gender differences for nasal length, nasal depth 2, hump. males had more values for soft tissue convexity in Anatolian Turkish adults. They found that High angle associated with convex nasal profile and low angle with straight or concave nasal profile.

Mandava prasad et al[26] observed that nasal length, nasal depth, columella convexity and nasal hump were more in males, nasolabial angle and nasal tip angle were wider in females..

Robert j begg et al[15] observed that males had significantly taller nose and longer dorsum and straighter nose than female there was no significant difference for males and females for nasal tip projection angle, nasal base angle, naso mental angle, nasolabial angle in randomly selected Caucasian subjects irrespective of underlying skeletal craniofacial morphology.

Enlow and hans reported that the male nose was proportionately longer than the female nose. **Kothari et al** observed that Male noses were larger in length and depth than female noses and the trend was the same in all groups for class I and class II malocclusion.**Subtelny**[4] first documented the downward and forward growth of nose that the nose grows more vertically when compared to its growth in the sagittal dimension and this vertical growth continues until 16 years in female and 18 years in males.

Grymer et al reported that deficient nasal septum growth along with decreased anteroposterior growth of maxilla leads to an upward displacement of anterior part of maxilla indicating strong relationship between nasal growth and inclination of maxillary plane. **Buschang** et al reported that the lower nasal dorsum was responsible for the angular changes. This resulted from the downward/backward or upward/forward movements of the pronasal point. **Nanda et al**[13] reported that the nasolabial angle decreased slightly from 7 to 18 years of age in both sexes.

Posan jm observed that Boys had larger nasal component dimensions than did girls, whereas girls appeared to have a greater degree of maturity in nasal and facial form than did boys at comparable ages in longitudinal study of Caucasian subjects from 3 months to 18 years. **Manera and subtelny** measuring changes in the inclination of the dorsum of nose relative to the facial plane, noted a reduction in this variable from 1 to 11 years followed by a mild increase up to 18 years. **Genecov et al**[11] concluded that the angular parameters of nasal complex between the age of 7 and 17 years remained relatively constant. **Posen** noted that female subjects demonstrated larger angular measurement than male subjects until 13 years of age and also did not find any change in upper nose inclination after 14 years of age in both sexes. ***Jeffrey S. Genecov*** **et al**[11] observed that anteroposterior growth and subsequent increased anterior projection of the nose continued in both males and females after skeletal growth had subsided. However, females had completed a large proportion of their soft

tissue development by age 12 while in males continued growth was noted until age 17 resulting in their having greater soft tissue dimensions for many of the parameters. **Behrents** have proposed that a considerable amount of nasal growth occurs even after puberty.

In the present study, most of the linear and angular parameters of cephalometric analysis for nasal proportions are found to be greater in males with average, horizontal and vertical growth pattern, these gender differences may be due to longer period of soft tissue development in males and also because females have early cessation of growth as compared to males but post pubertal growth may be responsible also.

In our study jarabaks ratio is taken to define growth pattern so further study is needed with other growth parameters along with sagittal relation.

CONCLUSION

Gender differences were found for nasal proportions in lateral cephalometric analysis

Males have longer and prominent nose in all growth patterns, but straight nose in average growth pattern., with hump in horizontal growth pattern, convex nose than females in vertical growth pattern,

Greater emphasis on soft tissue paradigm and nasal proportions is required for orthodontic diagnosis and treatment planning which should have to consider clinical examination in conjunction with cephalogram for individual patient's need and desires as well as genetic, racial and ethnic background.

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