Research Article

Vertical Proportion of the Face: A Cephalometric study

Dr. Rajiv Yadav[1], Dr. Kishor Dutta[2], Dr. Nabin Gosain[3], Dr. Anil K Yadav[4], Dr. Neelam Yadav[5], Dr. Kaushal K Singh[6]

[1]Associate Professor and Head, [2]Lecturer, [3]Orthodontic Resident, Department of Orthodontics and Dentofacial Orthopedics, Tribhuvan University Dental Teaching Hospital, Institute of Medicine, Maharajgunj Medical Campus, Kathmandu, Nepal
[4]Consultant orthodontist/Dental Surgeon, Narayani Hospital, Birgunj, Nepal
[5]Consultant Prosthodontist, MSDH (Multi-Specialist Dental Hospital) Pvt Ltd, Kathmandu, Nepal
[6]Lecturer, Department of Orthodontics and Dentofacial Orthopedics, National Medical College Teaching Hospital, Birgunj, Nepal

Corresponding author: Rajiv Yadav; Email: rraazzeevv@gmail.com

ABSTRACT

Introduction: Balance in vertical facial proportion is an important criteria for good esthetics. Variations in vertical growth are common and have certain orthodontic implications. The objectives of this study were to determine mean upper anterior facial height and lower anterior facial height, ratio between UAFH to LAFH and their difference among genders in skeletal Class I patients with different vertical growth pattern among patients visiting department of Orthodontic and Dentofacial orthopedics, Tribhuvan University Dental Teaching Hospital, Kathmandu.

Materials and Method: This study was descriptive observational cross sectional study with 105 sample aged from 18-25 years. Pretreatment cephalometric radiograph of Skeletal Class I patients were taken and divided into three growth patterns as group I (normal growth pattern), group II (horizontal growth pattern) and group III (vertical growth pattern). Upper anterior facial height (N-ANS) and lower anterior facial height (ANS-Me) of all samples were measured on lateral cephalogram with cephalometric tracing ruler parallel to true vertical line. Descriptive statistics was used to calculate mean, minimum, and maximum values standard deviations with p value <0.05.

Result: The upper anterior facial height (UAFH) and lower anterior facial height (LAFH) measurements in normal growth pattern was 52.37 and 64.4 , in horizontal growth pattern was 53.0 and 62.2, in vertical growth pattern was 53.37 and 64.42 respectively. The mean ratio of upper and lower anterior facial height in normal, horizontal and vertical growth pattern was 0.81, 0.85 and 0.79 respectively. There was no statistically significant difference in upper and lower facial heights between males and females. There was no statistically significant difference in UAFH between normal, horizontal and vertical growth pattern but statistically significant difference was observed in LAFH between groups.

Conclusion: The cephalometric values for different vertical groups in skeletal class I can be used more specifically for diagnosis and treatment planning of Nepali population.

KEYWORDS: Cephalometry, Lower Anterior Facial Height (LAFH), Upper Anterior Facial Height (UAFH), Vertical Patterns

INTRODUCTION

A well balanced face is important for ideal esthetics. Achieving good esthetics includes careful evaluation of the dentofacial complex in the anteroposterior, transverse, and vertical dimensions. The objective of orthodontic treatment is to obtain normal vertical proportion. According to Sassouni[1], the vertical facial forms are classified into long, average and short faces and reported a definitive correlation between facial patterns and anterior vertical facial proportions. Vertical dimension includes anterior facial height (AFH) and posterior facial height (PFH). Wylie and Johnson[2], in 1952 reported that in well-balanced individuals, total facial height (nasion-menton) is divided into 45% of nasal height or upper facial height (nasion-anterior nasal spine) and 55% of dental height or lower facial height (anterior nasal spine-menton). Schudy[3] introduced the terms “hyperdivergent” and “hypodivergent” as classifications of extremes along the vertical spectrum. Linear parameters like Jarabak’s

ratio and facial height ratio (LAFH/TAFH) are also used to assess the facial vertical growth of an individual[4,5]. Tweed[6] also emphasized the importance of the vertical proportion using mandibular plane angle in diagnosis and treatment planning. Vertical dimension includes the relationships between bone structures, dental tissue, and soft tissue, and thereby facilitates a complete assessment of the malocclusion[7]. The excessive growth in the facial vertical dimension may cause a gummy smile, inappropriate lips and the pattern of the long face and the decreased vertical dimension may result in the inadequate display of upper incisors, over-closure of the lips and the pattern of the short face[8]. In different population, the cephalometric values may vary due to difference in race and ethnicity[9]. Therefore, clinician should have sound knowledge of these variations so that desirable changes can be obtained[10]. Using only one standard for cephalometric analysis is not suitable for all population with different ethnic groups. Cephalometric standards of different ethnic and racial populations must be assessed separately. Based on literature reviews so far only few study has been conducted in Nepali population. Hence this study is proposed. This study will help to set baseline cephalometric value on vertical facial proportion among Nepali adults.

The aims of the study were to determine mean upper anterior facial height and lower anterior facial height, ratio between UAFH to LAFH and their difference among genders in skeletal Class I patients with different vertical growth pattern.

MATERIALS AND METHOD

A quantitative observational cross-sectional study was conducted at Department of Orthodontics and Dentofacial Orthopedics, Tribhuvan University Dental Teaching Hospital, Kathmandu. Ethical clearance (Reference No: 367(6-11)E2 077/078 was obtained from the Institutional Review Committee of Maharajgunj Medical Campus, Institute of Medicine, Kathmandu, Nepal. Routine cephalometric xrays of Skeletal Class I patients undergoing orthodontic treatment with normal growth pattern, horizontal growth pattern or vertical growth pattern were collected as samples adopting convenient sampling method. Collected samples were further divided into three groups based on growth patterns as group I (normal growth pattern), group II (horizontal growth pattern) and group III (vertical growth pattern).Sample size was calculated was done using power of study = 0.8, level of significance = 0.05. The calculated sample size was 105 with 54 females and 51 males with 35 samples in each group.The inclusion criteria were age: 18-25 years, Skeletal Class I patient with ANB of 0-4 degree[11], presence of all permanent dentition, good quality cephalometric radiograph with clearly identifiable landmarks and no tooth agenesis or previous extractions. The exclusion criteria were patient's with no previous orthodontic treatment and without any craniofacial anomalies. 25% lateral cephalograms radiograph were selected randomly for reliability check by lottery basis and were re-measured in one-week interval time for the intra-observer variation test. Cronbach Alpha was used for intra-observer variation test for lateral cephalogram radiographs which were observed to be 0.997 which was indicated more reliability between the measurements.

Lateral cephalograms used in this study were taken on Planmeca (Planmeca USA Inc, IL, USA) with Frankfort Horizontal Plane (FHP) was parallel to the horizontal plane. All radiographs were traced manually on acetate paper using an x-ray viewer. Following cephalometric parameters were taken:

1. S (Sella): Midpoint of the pituitary fossa in the sagittal plane
2. N (Nasion): Anterior point on the frontonasal suture
3. A (Point A): Deepest point on the concave outline of the upper labial alveolar process
4. B (Point B) The deepest point on the bony curvature between the crest of the alveolus and the Pogonion
5. Me (Menton) The lowest point on the lower border of the mandibular symphysis
6. ANB: Angle formed by the intersection of AN and NB.
7. ANS(Anterior nasal spine): Most anterior point of the premaxillary bone in the sagittal plane
8. UAFH (Upper Anterior Facial Height): Linear distance between points N and ANS, measured in N - Me line.
9. LAFH (Lower Anterior Facial Height): Linear distance between ANS and Me, measured in N - Me line.
10. TAFH (Total Anterior Facial Height): Linear distance between Nasion (N) and Menton (Me).
11. UAFH:TAFH :Ratio of Upper Anterior Facial Height and Total Anterior Facial Height
12. LAFH:TAFH :Ratio of Lower Anterior Facial Height and Total Anterior Facial Height

To determine the growth pattern in vertical dimension, angle between sella to nasion and gonion to gnation (SN-GoGn) from Steiner's analysis11 was taken. If Sella-

Nasion to Gonion Gnathion (SN –GoGn) was

1. <27° = Horizontal growth pattern
2. 32°± 5° = Normal growth pattern
3. >37° = Vertical growth pattern

Statistical Analysis:

Data were analyzed in SPSS for Windows (version 21, SPSS Inc. Chicago). Descriptive statistics was used to calculate mean, minimum, and maximum values standard deviations. Analysis of variance test was used to compare the studied parameters among the three skeletal pattern groups. To determine the correlation between facial height variables and the underlying skeletal pattern, Pearson's correlation coefficients were applied. A p-value of <0.05 was taken as statistically significant.

RESULT

The mean upper anterior facial height in skeletal Class I patients was found to be 52.452 with a standard deviation of 5.432 and the mean lower anterior facial height in skeletal Class I patients was found to be 64.676 with a standard deviation of 3.957. The mean ratio of upper and lower anterior facial height was 0.81. The mean upper anterior facial height in skeletal Class I patients in normal growth pattern was 52.371. The mean lower anterior facial height in skeletal Class I patients in normal growth pattern was 64.4. The mean upper anterior facial height in skeletal Class I patients in horizontal growth pattern was 53. The mean lower anterior facial height in skeletal Class I patients in horizontal growth pattern was 62.2. The mean upper anterior facial height in skeletal Class I patients in vertical growth pattern was 53.371. The mean lower anterior facial height in skeletal Class I patients in vertical growth pattern was 67.42.

The mean ratio of upper and lower anterior facial height in normal growth pattern was 0.81.The mean ratio of upper and lower anterior facial height in horizontal growth pattern was 0.85.The mean ratio of upper and lower anterior facial height in vertical growth pattern was 0.79.

There was no statistically significant difference in upper and lower facial heights between males and females with p value <0.05. (Table 2)

Table 1. Upper and Lower anterior facial height, total facial height and ratio of upper and lower anterior facial height in different facial types

Vertical facial type	Upper anterior facial height	Lower anterior facial height	Total facial height	UAFH/LAFH
Normal growth pattern	52.3	64.4	116.7	0.81
Horizontal growth pattern	53	62.2	115.2	0.85
Vertical growth pattern	53.3	67.42	120.7	0.79

Table 2: Independent t-test for comparison of means in males and females

	Sex	N	Mean	Std. Deviation	Std. Error Mean	sig
UAFH	Female	54	51.3889	2.26888	.30875	0.361
	Male	51	54.5294	1.96319	.27490	
LAFH	Female	54	62.9444	3.66223	.49837	0.821
	Male	51	66.5098	3.41978	.47887	

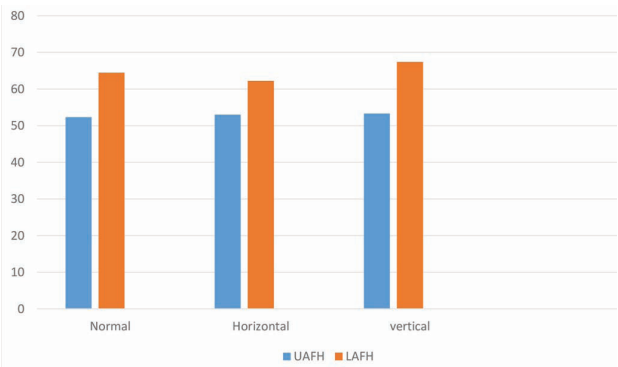

Figure 1. Upper and lower anterior facial height in normal, horizontal and vertical growth pattern

There was no statistically significant difference in UAFH between normal, horizontal and vertical growth pattern but statistically significant difference was observed in LAFH between groups. (Table 3)

Table 3 . One way ANOVA between different facial types

		Sum of Squares	Df	Mean Square	F	Sig.
UAFH	Between Groups	17.886	2	8.943	1.291	.279
	Within Groups	706.343	102	6.925		
	Total	724.229	104			
LAFH	Between Groups	482.419	2	241.210	21.458	.000
	Within Groups	1146.571	102	11.241		
	Total	1628.990	104			

DISCUSSION

Variation in vertical facial proportion in different race and ethnicity has been observed in various previous studies. In our study the mean value of UAFH and LAFH in males and females don't show significant differences. Previous studies[12-15] have also shown no significant differences between male and female. Studies by Kharbanda et al[16] in North Indians, Sheikh et al[17] in Bangadehi population, Imani et al[18] in Iranian population showed significant difference in anterior facial height with males having higher values than females.

The UAFH in normal, horizontal and vertical growth pattern doesn't show significant differences between groups. Study by Wang et al[19] done with 3D CBCT and Sheikh et al[17] also show similar results. According to Wang et al high or low mandibular plane angle might not necessarily be accompanied by long or short anterior face height, respectively.

The LAFH in normal, horizontal and vertical growth pattern showed significant differences between groups. Vertical growth pattern had a larger LAFH than normal growth pattern which in turn had larger LAFH than horizontal growth pattern. Moon et al[20] did a study in Korean population by classifying skeletal deep bite and skeletal open bite and also found a significant relationship between vertical growth pattern and anterior facial height. Vieire et al[10] showed similar results in Japanese Brazilian descendants. The total anterior facial height also showed similar trend as lower anterior facial height which may be due to the value of lower anterior facial height affecting the total anterior facial height.

The vertical pattern of face defines the variability in orthodontic mechanics, as well as in the facial proportions[21] so knowledge regarding the variability in local population helps in proper diagnosis and treatment planning.

CONCLUSION

The cephalometric values for vertical parameters in different growth pattern in skeletal class I subjects in patients visiting Orthodontic and Dentofacial Orthopedic Tribhuvan University Dental Teaching Hospital, Kathmandu was observed which gives a more specific information for the diagnosis and treatment planning with regard to orthodontic mechanics to be used. Results don't show significant differences in gender and UAFH but shows significant difference in LAFH.

Conflict of Interest: None

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