CORRELATION BETWEEN ANB ANGLE, LOWER ANTERIOR FACIAL HEIGHT AND ANTIGONIAL NOTCH-A CEPHALOMETRIC STUDY

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Abstract
Background: Cephalometrics is considered to be a precious tool in diagnosis and treatment planning. Assessment of diffrent angular and linear measurement and its correlation is highly significance in field of cephalometry. The various parameters like the ANB angle, lower anterior facial height and antigonial notch are the universally used parameters in various type of malocclusion.To correlate ANB angle, antigonial notch and lower anterior facial height in class I (Horizontal and vertical growth pattern) and class II malocclusion (Horizontal and vertical growth pattern) in post pubertal patient.
Materials and Method: A total number of 100 sample (n= 50 each groups) was included in this study. The sample was separated in two groups (group I and group II) on the basic of ANB angle to compare and correlate the ANB angle with lower anterior facial height and antigonial notch.
Results: The mean lower facial height (in mm) was compared between class I and II malocclusion using the Unpaired t-test. There was no significant difference in mean lower facial height (in mm) between both groups. Mean Antegonial notch (in mm) was compared between class I, II Horizontal and class I, II Vertical growers using the Unpaired t-test. The mean Antegonial notch was significantly more among class I Vertical growers. The mean Antegonial notch (in mm) was compared among group I and group II Horizontal and vertical seperatly growers using the Unpaired t-test. There was no significant difference in the mean Antegonial notch.
Conclusions: Amongst all three parameters (1 Linear and 2 Angular) in class I and II malocclusion, Antegonial notch was found to be deep in vertical growers as compared to the horizontal group. The LAFH (mm) was similar in class I and class II malocclusion irrespective of their growth pattern. Although on comparing the horizontal group of both Class I, II. There was no significant difference in antegonial notch.
Key words: Antegonial notch, lower anterior facial height, Horizontal and vertical growth patten, ANB angle.

Introduction

Cephalometric analysis has long been used for assessment of the bony structures of the face and craniofacial measurement[1] is an old diagnostic and evaluative tool used in orthodontics.
It also has a wide range of application in the field of orthodontics. As orthodontic diagnosis and treatment planning have become more sophisticated and scientific, more attention is given to the skeletal pattern, the amount and direction of facial growth, soft tissue, and position of the dentition.[2,3] Evaluation of diffrent angular and linear measurement and its correlation is highly significance in field of cephalometry.There are different linear and angular parameters used in different type of malocclusion to make reliable diagnosis and treatment planning. The various parameters like the ANB angle, lower anterior facial height and antigonial notch are the commonly used parameters in various type of malocclusion.
The ANB angle is very popular and useful in diagnosis and treatment planning. It is an integral part of steiner analysis. It measures the relationship between the maxilla and mandible.[4]
Antigonial notch is a concavity present in base of the mandible and its shape is different in various growth patterns. It play a vital role in orthodontics diagnosis and easily palpable clinically. Subjects with shallow notch associated with horizontal growth pattern which require longer duration of orthodontic treatment and subjects with deep notch associated with more vertical pattern.[5]
The lower anterior facial height is defined as the vertical expanse among the anterior nasal spine and the menton. Obviously this distance is potentially affected by the more increment or reduction through the compensatory growth pattern of the basoalveolar bone, and the dental eruption. The divergent growth pattern of the facial bones permits the vertical growth of the dentoalveolar components. It was reported that the lower anterior facial height affected with subject of average and deep bite patients[6].

Aim and Objective:

The purpose of this study is to
1. Correlation between Angles Class I and Angle Class II with lower anterior facial height.
2. Correlation between Angles Class I and Angle Class II with antigonial notch.
3. Correlation between Angles Class I, II (Horizontal pattern) and antigonial notch.
4. Correlation between Angles Class I, II (vertical pattern) and antigonial notch.
5. Correlation between Angles Class I (Horizontal and Vertical) with antigonial notch.

6. Correlation between Angles Class II (Horizontal and Vertical) with antigonial notch

Material and Method

Materials

Cephalostat (Planmeca Proline XC), Digital X-ray printer, Computer monitor, X-ray view box Acetate matte tracing sheet (0.003 inch).

Methodology

The study was designed and conducted in department of orthodontics and dentofacial orthopedics, Teerthanker Mahaveer Dental College and Research Centre, Moradabad. A total number of 100 sample (n= 50 each groups) included in this study. The sample was divided into two groups (Angles Class I and Class II) on the basic of ANB angle (55 males, 45 female) to compare and correlate the ANB angle with lower anterior facial height and antigonial notch. Now the sample was (n=100) further devided into four group (n=25 Class I horizontal and n=25 Class I vertical) and same in Angles Class II group (n=25 Class II horizontal and n=25 Class II vertical) on the basic of lower anterior facial according to jarabak ratio.

Cephalometric Assessment

Technique for lateral cephalogram

The lateral cephalogram of all samples included in study were taken with Planmeca proline XC X-ray machine (Planmeca QY, Finland). The radiograph were taken in natural head position with Frankfort horizontal plane parallel to floor. The radiographic films were exposed at 80 KV/8mA for 0.8 second. The film and subject distance was 5 feet and 2 inches.

Method of analyzing lateral cephalogram

The lateral cephalogram of all patient were 75 µm polyester acetate tracing papers(Garware Polyester Ltd, Mumbai) with 0.03 inch lead pencil was used to trace the lateral ceph. A single operator did all cephalometric tracing to avoid interoperator error, a total of 25 lateral cephalogram were selected randomly and traced for both angular and linear measurements by the same operator twice with an interval of 4 weeks to eliminate memory bias.

Cephalometric points and reference planes

1. Point N
2. Point A
3. Point B
4. ANS
5. Menton
6. Mandibular plane

Angular parameter

1. ANB angle
   Class I: 2 to 4 degree
   Class II: Greater than 4 degree
   Class III: Less than 2 degree

Linear parameter

1. Lower anterior facial height
2. Depth of antigonial notch

Lower anterior facial heigh

Lower anterior facial height is defined as vertical distance between ANS (situated in premaxilla) and menton.

Antigonial notch

Antigonial notch is defined as concavity present at the lower border of mandible and measure as perpendicular distance from mandibular plane.

Sample size calculation

The sample size was calculated using the **nMaster 2.0 software**. The power of the study was taken to be 80% and Confidence Interval (C.I.) of 95% was taken. The sample size calculation was done using the change in healing index. The sample size was estimated to be a minimum of 25 per group. The total sample size was estimated to be 50 for both the groups.

Statistical analysis

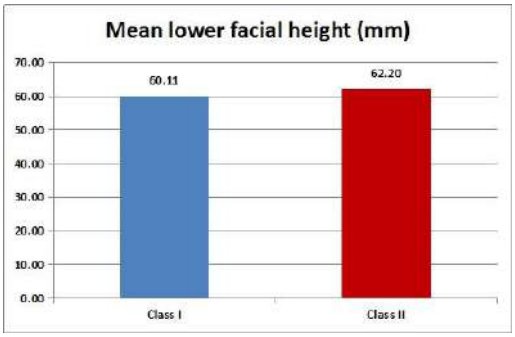
The data was entered into Microsoft Excel and analysed using SPSS (Statistical Package for Social Sciences) package for relevant statistical comparisons. Results were presented in the form of tables and graphs.

Descriptive statistics was performed by calculating mean, standard deviation, frequencies and percentages for the Continuous variables. Categorical variables were summarized as frequencies and percentages.

Shapiro Wilk test was used to check whether the continuous variables were following normal distribution or not. Inferential statistics will be done using the chi-square test for the categorical variables whereas the unpaired t-test was used for the comparison of Continuous variables between the 2 groups.Repeated measures ANOVA test with post-hoc bonferroni test for the comparison of the mean values over a period of time. The suitable Non-parametric test was used where the data does not follow the normal distribution.Level of statistical significance was set at p-value less than or equal to 0.05.

Results

The mean lower facial height (in mm) was compared between Class I and II malocclusion using the Unpaired t-test. There was no significant difference in mean lower facial height (in mm) between Class I and II malocclusion**.(Table 1, Graph 1)**

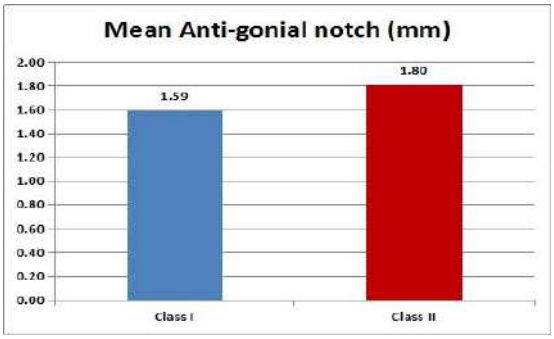


Graph 1-lower facial height (in mm) was compared between Class I and II malocclusion.

	LOWER FACIAL HEIGHT (mm)				
Malocclusion	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Class I	60.11	7.32	-2.08	-1.427	0.157
Class II	62.20	6.98			

Table: 1-Lower facial height (in mm) was compared between Class I and II malocclusion

The mean Antegonial notch (in mm) was compared between Class I and II malocclusion using the Unpaired t-test. There was no significant difference in mean Antegonial notch (in mm) between Class I and II malocclusion.**(Table 2, Graph 2)**

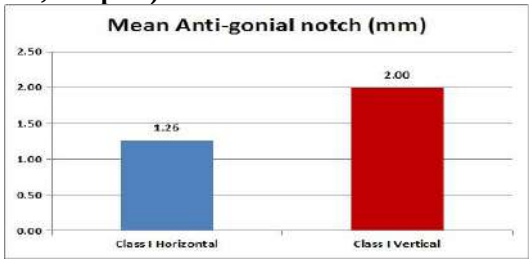


Graph 2-Antegonial notch (in mm) was compared between Class I and II malocclusion.

	ANTIGONIAL NOTCH (mm)				
Malocclusion	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Class I	1.59	1.06	-0.22	-0.887	0.378
Class II	1.80	1.29			

Table: 2-Antegonial notch (in mm) was compared between Class I and II malocclusion

The mean using the unpaired t-test. The mean Antegonial notch was significantly more among Class I Vertical growers in comparison to Class I Horizontal growers.**(Table 3, Graph 3)**

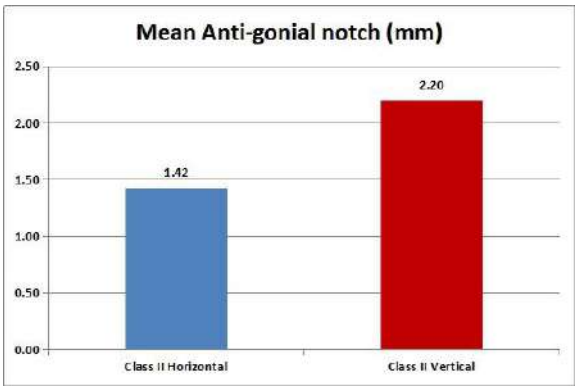


Graph3-Antegonial notch (in mm) was compared between Class I Horizontal and Class I Vertical growers.

	ANTIGONIAL NOTCH (mm)				
	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Class I Horizontal	1.26	1.02	-0.74	-2.465	0.018*
Class I Vertical	2.00	0.97			

Table: 3-Antegonial notch (in mm) was compared between Class I Horizontal and Class I Vertical growers.

The mean Antegonial notch (in mm) was compared between Class II Horizontal and Class II Vertical growers using the Unpaired t-test. The mean Antegonial notch was significantly more among Class II Vertical growers in comparison to Class II Horizontal growers.**(Table 4, Graph 4)**

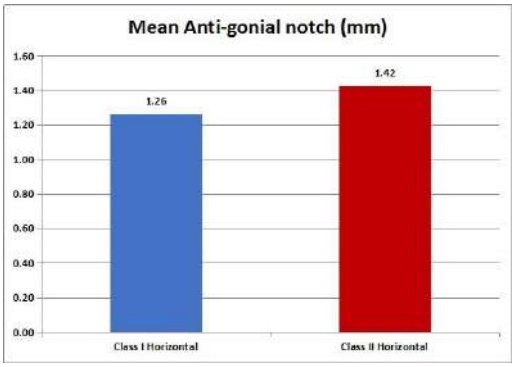


Graph 4-Antegonial notch (in mm) was compared between Class II Horizontal and Class II Vertical growers.

	ANTIGONIAL NOTCH (mm)				
	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Class II Horizontal	1.42	1.29	-0.78	-2.237	0.030*
Class II Vertical	2.20	1.18			

Table: 4-Antegonial notch (in mm) was compared between Class II Horizontal and Class II Vertical growers.

The mean Antegonial notch (in mm) was compared between Class I and Class II Horizontal growers using the unpaired t-te**st**. There was no significant difference in the mean Antegonial notch between Class I and Class II Horizontal growers.**(Table 5, Graph 5)**

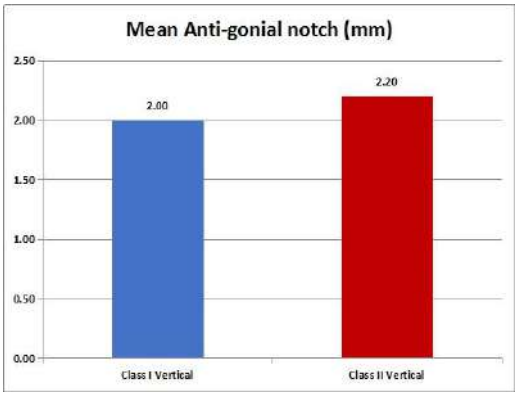


Graph 5- Antegonial notch (in mm) was compared between Class I and Class II Horizontal growers

	ANTIGONIAL NOTCH (mm)				
	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Class I Horizontal	1.26	1.02	-0.16	-0.498	0.621
Class II Horizontal	1.42	1.29			

Table: 5 Antegonial notch (in mm) was compared between Class I and Class II Horizontal growers

The mean Antegonial notch (in mm) was compared between Class I and Class IIVertical growers using the Unpaired t-test. There was no significant difference in the mean Antegonial notch between Class I and Class IIVertical growers.**(Table 6, Graph 6)**



Graph 6-Antegonial notch (in mm) was compared between Class I and Class II Vertical growers.

	ANTIGONIAL NOTCH (mm)				
	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Class I Vertical	2.00	0.97	-0.20	-0.609	0.546
Class II Vertical	2.20	1.18			

Table: 6- Antegonial notch (in mm) was compared between Class I and Class II Vertical growers.

Discussion

The study was conducted to correlate and compare the ANB angle, antegonial notch and lower anterior facial heights in Angles Class I and Class II malocclusion. The study includes 1 angular and 2 linear parameter. . The sample was divided into Class I and II with help of ANB angle. Steiner norms were followed in both groups. The ANB (less than 2 degree) was included in Class I sample and more than two degree was included in Class II sample. The criteria for Class I (horizontal and Vertical) and Class II (horizontal and Vertical) were divided with lower anterior facial heights norm by jarabak ratio.

In this study the angles Class I (horizontal and vertical) and Class II (horizontal and vertical) were correlated with antigonial notch depth.

The mean values for Class I (horizontal and vertical) were 1.26 and 2.00 and the mean difference for Angles Class I (horizontal and vertical) was -2.465. The mean Antigonial notch (in mm) was compared between Class I Horizontal and Class I Vertical growers using the Unpaired t-test. The mean Antigonial notch was significantly more among Class I Vertical growers in comparison to Class I Horizontal growers (p-value 0.018*).

In group of Class II (horizontal and vertical) mean values were 1.42 and2.20, standard deviation were 1.29 and 1.18 with mean difference of Class II horizontal -0.78. The mean Antigonial notch (in mm) was compared between Class II Horizontal and Class II Vertical growers using the unpaired t-test. The mean Antigonial notch was significantly more among Class II Vertical growers in comparison to Class II Horizontal growers (p-value 0.030).

Yasir A. yasir (2009) did a study on 191 sample of lateral cephalogram and stats that in Class II malocclusion the depth of antigonal notch was more when compared with Class I malocclusion.[7]

The similar study was done by gupta et al 2018 they correlate the antegonial notch with horizontal and vertical growth pattern in Angles Class II division I malocclusion. The antigonial were positively significant in both types of growth pattern.[8]

In group of Class I, II (horizontal) the mean values of antigonial notch were 1.26 and 1.42 with mean difference of -0.16(Class I horizontal). There was no significant difference in the mean Antigonial notch between Class I and Class II Horizontal growers (p-values 0.621).

In group of Class I, II (vertical) the mean value of antigonial was 2.00 and 2.20 with mean difference of -0.20(Class I vertical). There was no significant difference in the mean Antigonial notch between Class I and Class I Vertical growers (p-values 0.546).

Although we also correlate the Class I and Class II with antigonial notch. The mean values were 1.59 and 1.80(Class I, II). The standard deviation was 1.06 for Class I and 1.29 for Class II; there was no significant

difference in mean Antigonial notch (in mm) between Class I and II malocclusion (p-value 0.378).

Tomer at al 2009 also conducted a study on pretreatment cephalogram of 90 normal individual and results indicate that there were negative correlation between facial morphology (vertical plane) and depth of antigonial notch.[9]

The same result were found in study of Singer at al (2018).[10]

In correlation between Angles Class I and II with lower anterior facial height the mean Antigonial notch (mean value1.59 and 1.80), with standard deviation of 1.06 and 1.29 was compared between Class I and II malocclusion using the Unpaired t-test. The result was negatively significant.

The lower anterior facial height also plays a role in orthodontic diagnosis and treatment planning in vertical plane. Further study was done to correlate the lower anterior facial height with Angles Class I and Angles Class II malocclusion.

The mean lower facial height (in mm) was compared between Class I and II malocclusion using the unpaired t-test. The mean value in Class I and II were 60.11 and 62.20 and mean difference was -2.08 (Class I). There was no significant difference in mean lower facial height (in mm) between Class I and II malocclusion (p-value 0.157).

Ghulam et al 2011 performed a study on lateral cephalogram of 114 individual and conclude that the values of lower facial heights were disturbed from average in Peshawar population. Facial heights values were increased in population.[11]

Melvut (2015) did the similar study on correlation between lower anterior facial height in high and low angle cases. The study had no statistically relevant.[12]

Conclusion

From the above correlation the following conclusion can be drawn:

1. Amongst all three parameters (1 Linear and 2 Angular) in Class I and II malocclusion, Antegonial notch was found to be deep in vertical growers as compared to the horizontal group.
2. The LAFH (mm) was same in Class I and Class II malocclusion irrespective of their growth pattern.
3. Even on comparing the horizontal group of both Class I, II. There was no significant difference in antegonial notch. Similarly horizontal and vertical Class II malocclusion group also showed no significant difference in their antegonial notch.

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