Evaluation of Mandibular Morphology in Lateral Cephalograms

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Abstract

Background: Through observation, the mandibular antegonial notch presents as a concavity in the inferior border of the mandible, anterior to the gonial angle. Lateral cephalograms are commonly used for the evaluation of changes in a patient's growth pattern.
Aim: to assess the mandibular morphology with the usage of various parameters obtained from a lateral cephalogram.
Materials and Method: This study was executed on a total of 100 lateral cephalograms; which was composed of males and females at age range of 13-35. Lateral cephalograms were obtained from a software called FACAD, in which various data uploaded by the postgraduates from the Department of Orthodontics of Saveetha Dental College could be assessed. With this software, various parameters could be assessed and the measurements could be measured.
Results: In regard to the linear measurements of the samples obtained, the mean value that was calculated for the antegonial notch depth in males was shown to be 2.26, while in females it was seen to be 2.22. These findings showed that males have a higher value compared to the opposite sex. On an average, both the genders showed a mean of 2.24 in their antegonial notch depth. When the ramus height was evaluated, the mean value for males was 54.22 while in females it was 53.64. Overall, all 100 samples gave a mean value of 53.94 for the antegonial ramus height.

Conclusion: The ramus height was found to be significantly smaller in females than in males. Sexual dimorphism was significantly evident with males having greater ramus height than females. Similar to this finding, the antegonial notch depth revealed greater values in males. Gonial angle were found to be significantly increased in in males rather than in females.

Keywords: mandible, antegonial notch, lateral cephalograms, growth

Introduction

For a clinician, facial growth as well as its development is of a great concern. The reasoning behind this is because in orthodontic treatments, the amount and the direction of facial growth is in deep correlation with each other. [1] Specializing in orthodontics is significantly related to the interest of how the diagnosis, treatment, and response of various facial forms can result in various differences. With the presence of cephalometric imaging, a more advanced form of determining various facial patterns can be seen. Currently, with the advancement in radiography, the type of facial forms can be investigated in close relation with that of both skeletal and malocclusion relationships. [2] In a study that was done by Schudy, it concluded the importance of the relationship between anteroposterior as well as vertical dysplasias with that of vertical facial dimension specifically for orthodontic treatments.[3,4]

In reality, though the capability to predict the entire facial growth is very much desirable, evaluating the mandibular growth is much more of benefiting way of diagnosis and treatment planning. In various previous studies done, many methods were introduced for the prediction of mandibular growth with the implementation of many parameters. [5]

One of the many criteria that would be discussed in such a study is the characteristic of the antegonial notch present on the mandible. Antegonial notching has been of an interesting topic related to both the growth and development of the human mandible. Throughout the years, the antegonial notch can be viewed as a form of concave structure located in the inferior border of the mandible with the gonial angle located anteriorly. [6,7] In individuals with either acquired or congenital abnormalities of the mandible, a prominent antegonial notch could be observed. The depth onto which antegonial notch was formed till this day could not be fully understood. However, based upon Bjork's study, it showed that the backward growth pattern that the mandible possesses results in the surface deposition beneath the mandibular angle. This pattern results in a concave structure on the inferior border of the mandible which in this case is known as the antegonial notch. The other main criteria related to this study is the gonial angle. In some extreme conditions like a mass disaster, the gonial angle is of a useful indicator for human identification. [8,9,10]

The aim of this study was to assess the mandibular morphology with the usage of various parameters obtained from a lateral cephalogram.

Materials and Methods

This study was executed on a total of 100 lateral cephalograms; which was composed of males and females at age range of 13-35. The subjects were divided based on the age groups with the following guidelines as a reference:

Criteria of Selection:

- Overjet and overbite within normal range
- No decayed/missing dentition
- No previous history of any orthodontic treatment

Methods

Lateral cephalograms were obtained from a software called FACAD, in which various data uploaded by the postgraduates from the Department of Orthodontics of Saveetha Dental College could be assessed. With this software, various parameters could be assessed and the measurements could be measured.

The parameters that were followed in this study included:

Cephalometric Landmarks

1. Ar: Articulare—the point of intersection of the images of the posterior margin of ascending ramus and the outer margin of cranial base.
2. Go: Gonion—point of intersection of lines tangent to lower and posterior ramal borders of mandible projected on mandible (Brodie 1941).
3. Me: Menton—lowermost point on the outline of symphysis as seen in norma lateralis.
4. N: Nasion—the anterior most point of the frontonasal suture in the median plane.

Cephalometric linear measurements

1. Antegonial notch depth: distance along a perpendicular line from the deepest part of notch concavity to a tangent through the two points of greatest convexity on the inferior border of the mandible, either side of the notch (Singer *et al*, 1994). **(Figure 1)**
2. Ramus height: distance between Ar and Go. **(Figure 2)**

Figure 1: Antegonial Notch Depth

Figure 2: Ramus Height

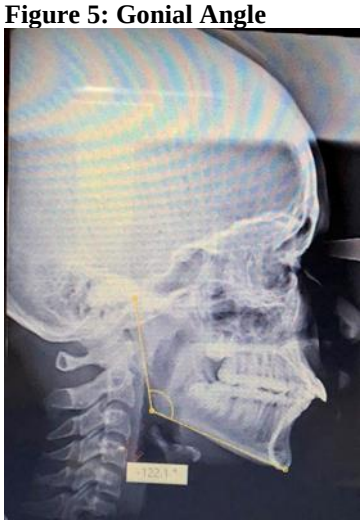
Cephalometric angular measurements

1. **Upper Gonial angle: angle formed by the points Ar, Go, N at Go. (Figure 3)**
2. **Lower Gonial angle: angle formed by the points N, Go, Me at Go. (Figure 4)**
3. **Gonial angle: angle formed by the points Ar, Go and Me at Go. (Figure 5)**

Figure 3: Upper Gonial Angle

Figure 4: Lower Gonial Angle

Figure 5: Gonial Angle



The sample size that was calculated for this study is 100 population. As it is conducted with a total of 100 lateral cephalograms, it is considered to be sufficient for the required sample size. (Figure 6).

Figure 6: Sample size calculation

Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc)(*N*):	200
Hypothesized % frequency of outcome factor in the population (*p*):	50%+/-7
Confidence limits as % of 100(absolute +/- %)(*d*):	7%
Design effect (for cluster surveys-*DEFF*):	1

Sample Size(*n*) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	100
80%	60
90%	82
97%	110
99%	126
99.9%	148
99.99%	160

Equation

Sample size $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$

Statistical Analysis

Once the data was obtained, the mean and the standard deviation were calculated. Analysis was done between the both the genders for each group of the measurements collected.

The data calculation as well as the data analysis was done through Microsoft Excel 2017. With the data, it was subjected to statistical analysis using Student T test, ANOVA.

Results

In regard to the linear measurements of the samples obtained, the mean value that was calculated for the antegonial notch depth in males was shown to be 2.26, while in females it was seen to be 2.22. These findings showed that males have a higher value compared to the opposite sex. On an average, both the genders showed a mean of 2.24 in their antegonial notch depth (Table 1).

When the ramus height was evaluated, the mean value for males was 54.22 while in females it was 53.64. Overall, all 100 samples gave a mean value of 53.94 for the antegonial ramus height (Table 1).

On the other hand, the standard deviation of the antegonial notch depth that was collected showed that males had a value of 0.70 while females had a value of 0.63; also proving that males have a slightly higher depth compared to females. Overall, the standard deviation for both genders are 0.66 (Table 1).

In regard to the standard deviation for the ramus height of the samples, males were seen to have a value of 8.79 while in contrast to females, the value was seen to be 7.50. For a total of 100 samples, the value was shown to be 8.15.

Parameters	Gender	Mean ± SD	p-value
Antegonial Notch Depth	M	2.26 ± 0.70	0.01
	F	2.22±0.63	0.01
Ramus Height	M	54.22±8.79	0.01
	F	53.64±7.50	0.01

TABLE 1: Linear Measurements

When it comes to the angular measurements of the given samples, for the upper gonial angle, the mean value for males was calculated to be 44.09 while in females it was 43.24. Overall, the average value for both was 43.67 (Table 2).

In relation to the lower gonial angle, the mean value for males were 76.45 while in females it was 79.84. For a total of 100 samples, the value was seen to be 78.11 (Table 3). For a complete gonial angle of the samples, males were shown to have a higher value which was 122.0 while in females the value was 122.99. Without dividing both the genders, the mean value was calculated to be 122.54 (Table 2).

On the other hand, the standard deviation of the upper gonial angle that was collected showed that males had a value of 5.34while females had a value of 4.93; also proving that males have a slightly higher upper gonial angle compared to females. Overall, the standard deviation for both genders are 5.13 (Table 2).

In regard to the standard deviation for the lower gonial angle of the samples, males were seen to have a value of 7.34 while in contrast to females, the value was seen to be 3.86. For a total of 100 samples, the value was shown to be 6.11.

When the gonial angle was measured on the other hand, the standard deviation for males was seen to be 6.37. In contrast, females were shown to be 5.26. When all 100 samples were taken into consideration, the standard deviation for both was shown to be 5.86 (Table 4).

Parameters	Gender	Mean ± SD	p-value
Upper Gonial Angle	M	44.09± 5.34	0.01
	F	43.24±4.93	0.01
Lower Gonial Angle	M	76.45±8.79	0.01
	F	79.84±7.50	0.01
Gonial Angle	M	122.00±6.37	0.01
	F	122.99±5.26	0.01

TABLE 2: Angular Measurements

Discussion

In regard to our study, the antegonial notch depth could be seen to be the highest in relation to that of males compared to females. When compared to that of a previous study, it showed that when sex is not to be considered, a higher reading was exhibited in people who are categorized in the hyper divergent group. [12] This finding was similar to one that was made through implant

studies; where there was a noteworthy difference when it comes to multiple cephalometric measurements. [13] This finding showed the true nature of people with extreme notch depth. In contrast to this, there was a negative correlation between that of both antegonial notch depth and horizontal jaw growth. [14,15]

Based on the data collected of the ramus height, it was clearly seen that males possess a higher ramus height when compared to the opposite sex. When compared in relation to that of Jarabak's ratio; which divides the obtained samples into normodivergent, hypodivergent and hyperdivergent, both the former showed a markedly increase ramus height. [16] These results were in relation to that of previous reports that were made by Swineheart, Sassouni, Muller and Schudy. The reason behind this is because the they too reported of a marked decrease in measurement in the hyper divergent group. [17,18]

When the angular measurements were made, the gonial angle showed a higher increase in males rather than in females. However, hyper divergent groups have shown to a have a significantly higher rather than that of hypo divergent groups. [19] Similar to that, various studies have also showed the same results that demonstrates how the obtuse gonial angle with that of skeletal open bite is in association with each other. The same thing also could be implied with a small angle and a deep bite. [20,21]

Conclusion

The ramus height was found to be significantly smaller in females than in males. Sexual dimorphism was significantly evident with males having greater ramus height than females. Similar to this finding, the antegonial notch depth revealed greater values in males. Gonial angle were found to be significantly increased in in males rather than in females.

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