

Gonial Angle Determination: Orthopantomogram V/S Lateral Cephalogram

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ABSTRACT

Background: The gonial angle is an important angle of the craniofacial complex. It is significant for the diagnosis of craniofacial disorders. Lateral cephalogram and Orthopantomograms can be used to determine this angle. Because of the superimpositions seen on lateral cephalograms, reliable measurement of the gonial angle becomes difficult.

Aim: To investigate whether Orthopantomogram (OPG) can be used as an alternative to lateral cephalogram for measuring the gonial angle.

Materials and methods: A total of 50 radiographs (25 males and 25 females) with age ranging from 15 to 30 years were collected from the record of department of Orthodontics and dentofacial orthopaedics, Patna dental college and hospital, Patna. Gonial angle was determined by the tangent of the inferior border of the mandible and the most distal aspect of the ascending ramus and condyle on both panoramic and cephalometric radiographs. The statistical analysis was performed using the SPSS version 20.0 (IBM Corp., Armonk, NY).

Results: The mean gonial angle was found to be 121.05° and 122.20° on panoramic and cephalometric radiographs, respectively. There was no statistical significant difference between the measured gonial angles on panoramic and cephalometric radiographs ($P > 0.05$).

Conclusion: Panoramic radiography can be used to determine the gonial angle as accurately as lateral cephalogram. In addition, we can determine the right and left gonial angles of a patient in an OPG without interferences due to superimposed images of anatomical structures in lateral cephalogram.

Keywords: Gonial angle, Lateral cephalogram, Orthopantomogram.

INTRODUCTION

Orthopantomogram (also known as Orthopantomograph, Pantomogram or OPG) is a panoramic single image radiograph of mandible, maxilla and teeth. It is an essential diagnostic aid in orthodontic diagnosis and treatment planning. It is used to provide important information about the teeth, period of maturation, axial inclinations of teeth and surrounding tissues¹⁻². It provides a

convenient, inexpensive and rapid way to evaluate the gross anatomy of jaws and related pathology³.

The gonial or mandibular angle is a significant angle of the craniofacial complex. Growth pattern of individual can easily be determined with the help of this angle⁴. This angle is also quite useful in determining the need of surgical treatment in skeletal class III patients⁵ and also to determine

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teeth extraction pattern in Class II patients . It is measured by drawing a tangent to the posterior border of the ramus and a tangent to the lower border of the mandible on a cephalometric radiograph. This angle is usually measured on a lateral cephalogram. However, according to Larheim and Svanaes⁶, on account of the superimposition of the right and the left angles in a lateral cephalogram, accuracy of measurements of the gonial angle is questionable. Recent investigations have featured that OPG can be utilized to ascertain the gonial angle. According to Mattila et al⁷, OPG can be used to measure gonial angle more correctly than a lateral cephalogram, as the right and left gonial angles can be estimated independently with no superimposition. Shahabi *et al* also added that OPG can be used to measure the gonial angle as accurately as a lateral cephalogram. He found that the value of gonial angle measured on OPG was almost similar to that measured on a dried mandible because of the lack of superimposition and ease of measurement in an OPG⁸. Based on all these findings, the motivation behind this study was to find out whether Orthopantomogram can be utilized as an option in contrast to lateral cephalogram for measuring the gonial angle.



Fig 1: Gonial angle measurement in OPG.

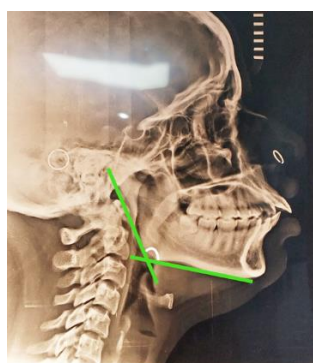


Fig 2: Measurement of Gonial angle in Lateral cephalogram.

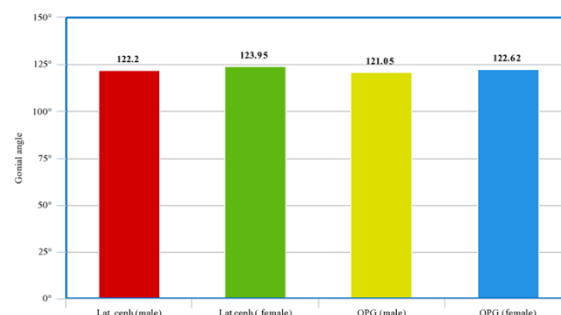


Fig 3: Gender distribution of mean value of Gonial angle in lateral cephalogram and Orthopantomogram.

Table 1: Mean, standard deviation and range of Gonial angle in lateral cephalogram and OPG.

variable	Mean (s.d) (In degrees)	range
Gonial angle in lateral cephalogram	122.20(4.86)	108.10-132.50
Gonial angle in OPG	121.05 (4.97)	108.59-131.06
Right Gonial angle in OPG	120.89 (4.90)	108.27-131.05
Left Gonial angle in OPG	121.22 (3.92)	109.23-131.58

Table 2: Comparison of Gonial angle in lateral cephalogram and OPG.

Variables	Mean difference (in degrees)	P
Gonial angle in cephalogram and OPG	1.19	0.239
Right and left gonial angle in OPG	0.34	0.735
Gonial angle in cephalogram and OPG (males)	1.15	0.255
Gonial angle in cephalogram and OPG (females)	1.33	0.189
Right gonial angle in OPG and lateral cephalogram	1.29	0.203
Left gonial angle in OPG and lateral cephalogram	0.71	0.481

Recent studies have highlighted that OPG can be used to calculate the gonial angle. According to

Mattila et al⁷, panoramic radiography can be used for determining the gonial angle more accurately than lateral cephalography, as the right and left gonial angles can be measured individually without any superimposition. Shahabi *et al* also concluded that panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram. The gonial angle assessed from a panoramic film was almost identical to that measured on a dried mandible because it can be determined more easily in an Orthopantomogram (OPG) than in a lateral cephalogram⁸. On the basis of above mentioned literature, the purpose of this study was to find out whether panoramic radiographs can be used as an alternative to lateral cephalogram for measuring the gonial angle.

MATERIALS AND METHOD

Cephalometric radiographs and Orthopantomograms for this study were obtained from the patient records of the Department of Orthodontics and Dentofacial Orthopedics, Patna dental college and hospital, Patna. A total of 50 radiographs (25 males and 25 females of age ranges between 15-30 years) were taken and traced upon a 0.003 mm matte acetate tracing paper with 3H lead pencil. In the OPG, a line was drawn tangent to the lower border of the mandible and another tangent line to the distal border of the ascending ramus and the condyle on both sides to measure the gonial angle (Fig. 1). In the cephalometric radiograph, the gonial angle was constructed by the intersection of the two tangential lines; one to the lower border of the mandible and the other to the distal border of the ascending ramus and the condyle (Fig. 2).

Statistical analysis

The data recorded were subjected to statistical analysis to find out the value of mean and standard deviation. The paired t-test was used for evaluating the difference between the gonial angle in the lateral cephalograms and that in the panoramic radiographs, and the Student t-test was used for evaluating the difference in the gonial angle with respect to gender. The statistical significance for all the tests carried out was defined as $p < 0.05$. The analyses were performed using SPSS version 20.0 (IBM Corp., Armonk, NY).

RESULT

The result showed a mean value of 122.20° of the gonial angle in lateral cephalogram with a standard deviation of 4.86° . The mean value of the gonial angle in panoramic radiographs was 121.05° with a standard deviation of 4.97° . In panoramic radiographs, the mean value of the right gonial angle was 120.89° , with a standard deviation of 4.90° , and the mean value of the left gonial angle was 121.22° with a standard deviation of 3.92° [Table 1]. The mean value of gonial angle in lateral cephalogram was found to be 122.20 in males and 123.95 in females whereas the same angle in OPG measured 121.05 in males and 122.62 in females [Figure 3].

There were no significant differences between the values of gonial angle determined by lateral cephalogram and panoramic radiography ($P = 0.239$). In panoramic radiography, there was no significant difference between the right and left gonial angles ($P = 0.735$) [Table 2]. The result showed that the difference between the mean gonial angle in lateral cephalogram and panoramic radiography was 1.33° in females and 1.15° in males, both of these values were statistically not significant.

DISCUSSION

Gonial angle is an important angle of the mandible as well as of craniofacial complex. It plays a very essential role in predicting growth of the mandible. It also influences profile, and the position of the mandibular anterior teeth and hence the correct assessment of this angle is essential for accurate diagnosis and treatment planning. This study was performed to assess and compare the measurement of gonial angle from panoramic radiographs and lateral cephalograms

In the present study, the mean value of gonial angle was found to be $122.20^\circ \pm 4.86^\circ$ in the lateral cephalogram and $121.05^\circ \pm 4.97^\circ$ in the panoramic radiograph with no significant difference between the two radiographs ($P = 0.239$). The mean value of the right gonial angle measured $120.89^\circ \pm 4.90^\circ$ whereas the left gonial angle showed a value of $121.22^\circ \pm 3.92^\circ$, the difference being statistically non significant. Similar results were obtained by Larheim et al⁶ and Bhullar et al⁹ who reported no

statistically significant differences in the gonial angle measured using cephalometric radiograph and OPG. In contrast to the findings of present study, Mattila et al⁷ reported a more accurate measurements on OPG than lateral cephalograms by comparing the value with those of dry skulls. Shahabi et al⁸ compared value of external gonial angle on the two radiographs of class I patients and found the value of lateral cephalogram as accurate as of OPG. Araki et al.⁹, in 2015, studied gonial angle in 49 panoramic radiographs and compared it with lateral cephalogram taken from 2 dry mandibles. He reported that the gonial angle measurements were slightly smaller on the OPG than on the lateral cephalometric radiographs.

A different result with statistically significant difference was reported by Fisher-Brandies *et al*¹⁰ who found that the gonial angle measured on OPG was 2.2–3.6° lesser than that of lateral cephalogram. Fatahi and Babouei (2007)¹¹ reported highest correlation between the values of gonial angle in OPG and lateral cephalometric radiographs obtained from dry skulls.

In this study, no statistically significant difference was observed when the value of gonial angle was compared between males and females. Similar results were obtained by Dutra et al¹² and by Altonen¹³. No gender-based differences in the gonial angle were found by them. However Ghosh et al¹⁴ and Bhardwaj et al¹⁵ reported that females had a larger gonial angle which might be due to the impact of masticatory forces.

CONCLUSION

Panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram as there are no significant differences in the gonial angle values as measured on cephalogram and OPG. In addition, OPG forms an additional tool for easier and more accurate determination of both right and left gonial angles of a patient without interferences due to superimposed images of anatomical structures in a lateral cephalogram. For determination of the gonial angle, an OPG may be a better choice than a lateral cephalogram.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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