

# Comparative Evaluation of The Efficiency of Panoramic Radiographs and Lateral Cephalograms in The Determination of Right and Left Gonial Angles

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## ABSTRACT

**Introduction:** Attainment of the best results post orthodontic treatment is majorly dependent on proper diagnosis and a good treatment plan. Diagnostic records lay the foundation of formulation of a good treatment plan. Among which lateral cephalograms and panoramic radiographs are important tools. Required knowledge about various parameters can be obtained by making certain linear and angular measurements. Gonial angle is one such parameter which helps an orthodontist in determining the facial pattern of an individual and thus altering the treatment plan as required.

**Objective:** The aim of the present study was to evaluate the efficiency of lateral cephalograms and panoramic radiographs in the determination of right and left gonial angle and determination of the accuracy of both.

**Materials and Methods:** Pre-treatment lateral cephalograms of 120 skeletal class I subjects were randomly selected and divided into 60 males and 60 females. Radiographic landmarks were located, identified and marked and various measurements were made. The measurements thus obtained were statistically analysed.

**Results:** The mean value of gonial angle measured using the panoramic radiograph was 124.75 and that of lateral cephalogram was 125.12. No statistically significant difference was found between the gonial angle measured

using lateral cephalograms and that using panoramic radiographs.

**Conclusion:** With the present study, it can be concluded that both lateral cephalograms and panoramic radiographs effectively measure the gonial angles. However, no statistically significant difference was found in the measured angle with the two radiographs.

**Keywords:** Panoramic Radiographs, Lateral Cephalograms, Gonial Angles

## INTRODUCTION

With changing times, the demands of the patients from the orthodontic treatment have evolved. As it is well said that "Half knowledge is worse than ignorance", the internet sometimes misguides the patient to study and plan their treatment on their own. It is the role of the orthodontist to make the patient aware about the possible deleterious effects of doing so.

Attainment of the best results post orthodontic treatment is majorly dependent on proper diagnosis and a good treatment plan. Various diagnostic aids are the radiographs, photographs and study models. As orthodontic treatment is complex, multiple data need to be analysed so that a good treatment plan can be formulated.<sup>1</sup> Diagnostic radiographs like the lateral cephalogram and panoramic radiographs

play an important role in determination of the treatment plan. They can be used to evaluate the skeletal relationship, growth pattern, dentition, individual tooth inclinations and the alveolar process.<sup>2</sup> On such important parameter is the Gonial angle, it helps in the determination of growth pattern, mandibular rotations, extraction decisions in Class II patients<sup>3</sup> and age estimation in forensic odontology.<sup>4</sup> Lateral cephalograms have been used to measure the gonial angle since a very long time but according to Larheim and Svanaes, the accuracy of measurements of the gonial angle using lateral cephalograms is questionable because of the superimposition of the right and the left angles.<sup>5</sup> However, according to Mattila et al, panoramic radiographs can be used to measure the gonial angle more efficiently as there is no superimposition of the two sides.<sup>6</sup>

### Aims And Objectives

The aim of the present study was to evaluate the efficiency of lateral cephalograms and panoramic radiographs in the determination of right and left gonial angle and determination of the accuracy of both.

### MATERIALS AND METHODS

The study was conducted on the subjects who visited the department for seeking orthodontic treatment. Lateral cephalograms and panoramic radiographs of 120 subjects

which were divided into two equal groups consisting of 60 males and 60 females with the mean age of  $24 \pm 2.5$  years.

The following was the selection criteria: -

### Inclusion Criteria:

1. High quality pre-treatment lateral cephalograms.
2. All radiographs had to be taken using the same apparatus.
3. Post growth subjects at least CVM5 maturation stage.

### Exclusion Criteria:

1. No previous orthodontic treatment.
2. No craniofacial syndromes.
3. No history of maxillofacial trauma or previous surgeries.

After obtaining standardized lateral cephalograms of the subjects, manual tracing was done on the radiographs. Various anatomic landmarks were located, identified and marked on each tracing. On both radiographs, lines tangential to the mandibular lower border (mandibular plane) and those tangential to the posterior border of the ramus and condyle (ramal plane) were drawn. On the OPGs, the GoAng was measured for both left and right sides. The gonial angle at the intersection of these planes was traced on tracing paper and measured using a protractor (Figures 1 and 2).

Figure 1: Gonial Angle on Lateral Cephalogram

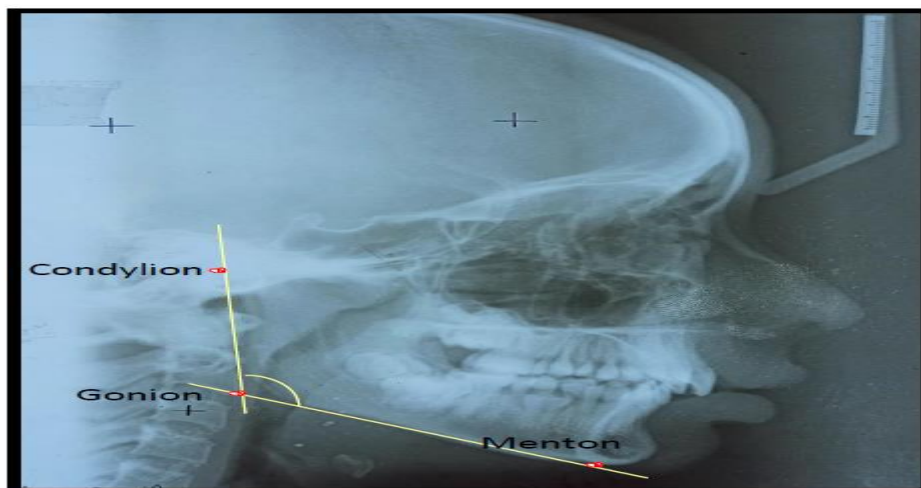
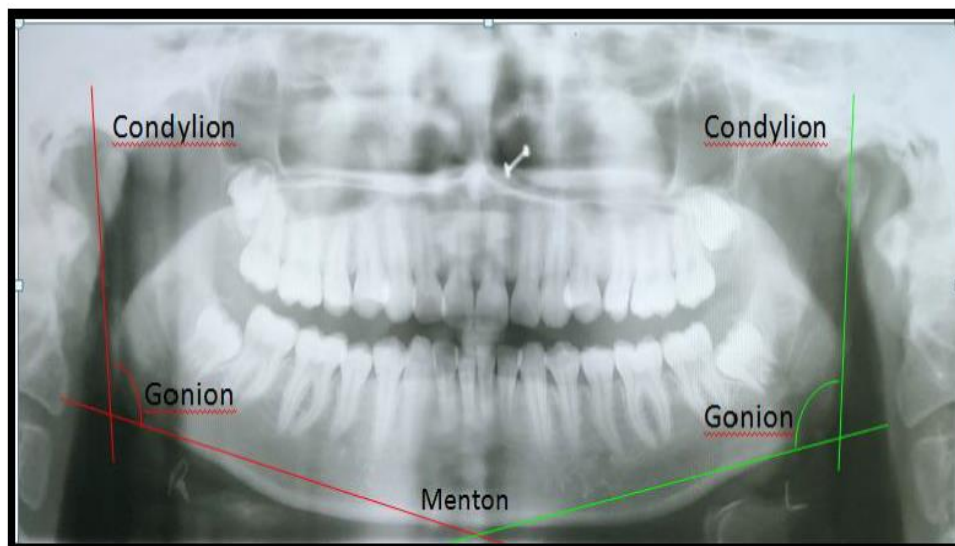


Figure 2: Gonial Angle on Panoramic Radiograph



### Method Error

Radiographic tracings were evaluated twice by the same examiner with an interval of one week difference. Assessment of intraexaminer reliability was done using Kappa statistics which showed perfect agreement (Kappa = 0.80-1.00,  $p < 0.001$ ).

### STATISTICAL ANALYSIS

All the measurements were analysed using SPSS software version 21. Paired t test and ANOVA were done to analyze the results after the descriptive statistics. To compare the two techniques in terms of Go-Ang measurement, Bland-Altman analysis was used. The level of statistical significance used in this study was set at  $p \leq 0.05$ .

### RESULTS

The study sample consisted of lateral cephalograms and panoramic radiographs of

120 subjects (60 females and 60 males; mean age,  $24 \pm 2.5$  years) with skeletal class I malocclusion. The mean value of the gonial angle measured using the lateral cephalograms was  $125.12^\circ$ , and that of the gonial angle measured using the panoramic radiographs was  $124.75^\circ$ . No statistically significant difference was found between the gonial angle measured using lateral cephalograms and panoramic radiographs ( $p = 0.1$ ) Table 1). The mean value of the gonial angle measured using the lateral cephalograms in females was  $122.45^\circ$ , and in males  $123.34^\circ$  which was statistically non-significant. Further, the mean value of the gonial angle measured using the panoramic radiographs in females was  $123.72^\circ$ , and in males, it was  $122.56^\circ$ ; which was also not statistically significant (Table 2).

Table 1: Gonial Angle Measurements on Lateral Cephalogram and Panoramic Radiograph

PARAMETER	N	MEAN	STANDARD DEVIATION	STANDARD ERROR
CEPHALOMETRIC GONIAL ANGLE	120	125.12°	6.618	1.036
GONIAL ANGLE OPG (RIGHT)	120	124.23°	6.508	1.050
GONIAL ANGLE OPG (LEFT)	120	124.51°	6.72	1.046
GONIAL ANGLE OPG (TOTAL)	120	124.750°	6.75	1.042
ANOVA				
PARAMETER		F	SIG.	
CEPHALOMETRIC GONIAL ANGLE		0.118	0.765	
GONIAL ANGLE OPG (RIGHT)		0.141	0.532	
GONIAL ANGLE OPG (LEFT)		0.121	0.622	
GONIAL ANGLE OPG (TOTAL)		0.151	0.714	

Table 2: Comparison of Gonial Angles in Males and Females

GENDER	N	MEAN	STANDARD DEVIATION	STANDARD ERROR
<b>CEPHALOMETRIC GONIAL ANGLE</b>				
MALE	60	123.34°	6.12	0.922
FEMALE	60	122.45°	6.56	0.942
<b>GONIAL ANGLE OPG (RIGHT)</b>				
MALE	60	121.52°	7.02	0.982
FEMALE	60	122.24°	6.89	0.927
<b>GONIAL ANGLE OPG (LEFT)</b>				
MALE	60	123.11°	7.11	0.918
FEMALE	60	122.56°	6.94	1.022
<b>GONIAL ANGLE OPG (TOTAL)</b>				
MALE	60	122.56°	6.83	1.121
FEMALE	60	123.72°	6.24	0.972

## DISCUSSION

The importance of radiographs as a diagnostic tool has been widely accepted. However, there have always been conflicts regarding the better radiograph as a diagnostic tool. According to Mattila *et al.*<sup>7</sup> and Dahan *et al.*,<sup>8</sup> the size of the gonial angle depends on the method of measurement used. The measurement could either involve the horizontal side of the gonial angle formed by the tangent to the lower border of the mandible or be based on a line passing through the gnathion. On a lateral cephalogram, both planes can be easily determined, but on a panoramic radiograph, the determination of the gnathion could be difficult and might result in an inaccurate measurement of the gonial angle. Thus, in this study to avoid any inaccuracies in the measurements used, the horizontal plane of the gonial angle in both the panoramic radiograph and the lateral cephalogram was formed by a line drawn tangentially to the lower border of the mandible.

The mean values of the gonial angle measured using the panoramic radiographs and the lateral cephalograms were 124.75° and 125.12°, respectively. Further, no statistically significant difference was observed in the gonial angle measured using these 2 diagnostic tools ( $P=0.1$ ). The results of our study were in agreement with the study done by Larheim *et al.*<sup>5</sup> and Bhullar *et al.*<sup>9</sup> who reported no statistically significant differences in the gonial angle measured using lateral cephalograms and panoramic radiographs. According to Nohadani and Ruf<sup>10</sup> angular values from panoramic

radiographs are more reliable, whereas Fischer-Brandies *et al.*<sup>11</sup> preferred only lateral cephalograms for determining the gonial angle.

The goal of the present study was to establish the use of panoramic radiographs in clinical orthodontics. Most of the literature available lays emphasis on the amount of magnification and image distortion seen in panoramic radiographs, however certain studies also consider the use of panoramic radiographs in using it as an effective diagnostic tool. As the results of our study concluded that no statistically significant differences were found in the measurements on lateral cephalogram and panoramic radiograph, thus OPG's can be used as an aid in the measurement of gonial angle as well as other parameters. In a study conducted by Ongkosuwito *et al.* (2009)<sup>12</sup>, it was concluded that an OPG is as reliable as a lateral cephalogram for linear measurements of the mandible, i.e., condylion-gonion, gonion-menton and condylion-menton.

Moreover, there was no statistical difference between right and left gonial angle in panoramic radiographs which coincides with previous studies and hence failed to find any gender difference in gonial angle from two different radiographs. In this study, the mean values of the right and left Go angles measured on OPGs were slightly smaller than those reported by Shahabi *et al.*<sup>13</sup> who used the same mandibular and ramal planes for Go angle measurements as were used in this study.

Most of the literature that is available states that the correlation between lateral

cephalogram and panoramic radiograph in the measurement of radiographic parameters is high. Also, in the present study no correlation between the genders was found, this is in agreement with the study done by Ceylan *et al*<sup>14</sup>. Further, Raustia AM *et al*<sup>15</sup> could not establish any significant difference between sexes and gonial angle, further supporting the findings of our study. They concluded that panoramic radiographs and lateral cephalogram are a useful tool for the measurement of gonial angle, which is an indicator of mandibular steepness and, subsequently, mandibular growth direction. Panoramic radiograph thus acts as an additional tool in the assessment of various radiographic parameters without any superimposition of the right and left sides, some amount of magnification however occurs in the midline structures. As with a lateral cephalogram superimposition of the right and left sides occurs commonly, thus for the determination of gonial angle, OPG can be considered as a good alternative. Thus, the present study substantiates the possibility of enhancing the clinical application of OPG as an alternative to lateral cephalogram in certain cases.

## CONCLUSION

The present study concludes that both lateral cephalogram and panoramic radiograph can be used as an important diagnostic tool as there was no significant difference in the values of gonial angle measured with both the radiographs. Panoramic radiographs can be used as accurately as lateral cephalograms in measurement of gonial angle. In addition, OPG acts as an additional tool in determination of radiographic parameters as the right and left sides can be measured separately without any superimpositions and can be considered better when both the sides are to be measured separately. Also, no statistically significant differences were found between the genders. Thus, it can be concluded that both lateral cephalogram and panoramic radiographs are vital and versatile

diagnostic tools in orthodontic treatment planning

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