

# RELIABILITY OF PANORAMIC RADIOGRAPHY IN ASSESSING GONIAL ANGLE COMPARED TO LATERAL CEPHALOGRAM

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## ABSTRACT

*Gonial angle is one of the most important values in cephalometric tracing and is used to measure growth pattern of patients, teeth extraction pattern in Class II patients, surgical decision in class III skeletal base patients and age estimation in forensic medicine. Gonial angle measured from panoramic radiograph (OPG) is found to be more reliable than lateral cephalometric radiograph. It is difficult to measure gonial angle accurately on the cephalometric radiograph as there is superimposition of the left and right sides angle. The aim of this study was to test the similarity of left and right sides of OPG in measuring the gonial angle and to check whether these values are identical with the values of gonial angle measured from lateral cephalometric radiograph. A hospital-based survey of patients visiting the staff clinic of college of Dentistry, Aljouf university from 1st October 2017 to 30th March 2018. The radiographs (Panoramic radiograph and lateral cephalometric radiograph) were prescribed and gonial angle traced to check their accuracy. Statistically significant difference was found when measurements yielded from panoramic images (right and left) and lateral Cephalometric measurements were compared (0.029 and 0.002). The gonial angles measured from left and right sides of panoramic images were equally reliable but when these measurements were compared to the gonial angles measured on the cephalometric radiographs, the measurements were found statistically different.*

**Key Words:** Panoramic radiography, Lateral Cephalometric radiography, Gonial angle

## INTRODUCTION

Panoramic radiograph has been extensively used in dentistry for diagnosing various pathologies.<sup>1-3</sup> Most of the patients who need correction of malocclusion are advised to get a panoramic radiograph.<sup>4</sup>

To assess the growth pattern of the patient measuring the gonial angle is very important<sup>5</sup>, It is also valuable in deciding teeth extraction pattern in Class II patients<sup>6</sup>, to decide either surgical or camouflage treatment in skeletal class III patients<sup>7</sup> and determination of age in forensic medicine.<sup>8</sup> New current studies have shown that panoramic radiograph can be used to measure the gonial angle which is an important measurement in cephalometric diagnosis.<sup>9</sup> Due to the superimposition on right and left side on the lateral cephalometric radiograph the gonial angle measurement is not accurate and also it is difficult to measure. It is also found that the value of gonial angle measured from panoramic radiographs are similar to the values obtained from dried human mandibles.<sup>10</sup>

Gonial angle value can be obtained by two ways of measurement. One way is that a tangent is drawn to the posterior border of mandibular ramus and it is intersected with another line which passes through the gonion and gnathion of the mandible.<sup>11</sup> The other way is to construct a tangent on the mandible lower border and another tangent to the posterior border of the ramus and condyle and measure the angle between these two lines.<sup>12</sup> The second method was used to measure the gonial angle as it is not easy to locate the gnathion on the lateral cephalogram.

The main aim of carrying out this study was to check the accuracy of gonial angle measured from panoramic radiographs left and right side and then compare them to the gonial angle value from lateral cephalograms. The importance of conducting this study is to look for the possible application, reliability and accuracy of panoramic radiograph for gonial angle measurement by finding out if there is any significant difference between right and left side of values on OPG and also between OPG and lateral cephalogram. This will help us to determine the increase the use of panoramic radiography for gonial angle measurements for Saudi population or otherwise.

## MATERIALS AND METHODS

In this cross-sectional study the data of patients who visited the staff clinic of the college of Dentistry,

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Aljouf University was used.

A serial number was given to all patient to protect his/her confidentiality. The study was conducted from 1<sup>st</sup> October 2017 to 30<sup>th</sup> March, 2018 which is about nine months. 85 patients records were studied <sup>13</sup> (50 male and 35 female patients). The patients with ages ranging between 16-26 years having class I malocclusion were selected. Two orthodontists did radiographic analysis. 2H pencil was used to draw the tangents. For each patient the OPG and Lateral Cephalogram were exposed with a Cranex D digital X-ray unit, Version 3 (Soredex Co., Tuusula, Finland). The machine was set at 80 KVP for panoramic radiograph and at 71 KVP for lateral cephalometric radiograph. 18 seconds exposure time was selected through 2.9 mm Al filtration for both radiographs. For quality and sharpness the radiographs were analysed by two experienced orthodontists. The Patients who had any kind of past maxillofacial surgery, syndromes which had affected face and jaws and incomplete records were not studied. This study was approved by the Ethical Committee of college of Dentistry Aljouf University and consent was obtained from the all volunteers.

The gonial angle was measured between the two tangent lines, on both OPG and lateral cephalogram. One tangent was drawn to the posterior border of the ascending ramus and condyle and the other tangent to the lower border of the mandible (Figure 1 and 2). Using a D (protector), the gonial angle traced on the acetate tracing paper was measured to 1 degree accuracy. Gonial angle was measured two times with a gap of 30 days and the method error was calculated using Dahlberg's double determination formula (Table 1).<sup>14</sup> SPSS version 20 was used for data analysis. To compare the variables Paired sample t-test was used.

$P \leq 0.05$  was set as the level of significance.

## RESULTS

Table 1 shows the mean, standard deviations of gonial angle measured from both the radiographs. Statistically no significant difference was found when right and left side gonial angle values on OPG were compared (0.135). When panoramic measurements (right and left) and lateral cephalometric measurements were compared, a significant difference was found (0.029 and 0.002; Table 2).

## DISCUSSION

This study was conducted to check the accuracy of gonial angle values measured from both sides of OPG and to compare them to each other (right and left sides comparison on OPG) and to the the values measured from lateral cephalograms. To accurately determine the changes after orthodontic treatment, measurement of the gonial angle on the right and left side s of OPG make it possible.<sup>10</sup> OPG has been found to be useful in measuring mandibular inclination and gonial angle. Since the gonial angle is a good indicator of mandibular steepness and growth direction assessment of the angle on the right and left panoramic radiographs makes it easier. Because dentists routinely request OPG during dental examination, for determining growth direction, they can also detect the vertical growth problems.<sup>16</sup> The form and shape of the mandible is shown by the gonial angle thus it has a crucial role in predicting the upcoming mandibular growth direction and it also has certain effects on facial profile changes and the inclination of the mandibular anterior teeth.<sup>15</sup>

The prupose of carrying out this study was to determine if the OPG could be used in measuring the gonial

TABLE 1: DESCRIPTIVE STATISTICS AND CORRECTION METHOD OF GONIAL ANGLE IN LATERAL CEPHALOGRAM AND OPG

	Lateral cephalogram	Panoramic Right	Panoramic Left
Mean	135.78	130.12	123.32
+SD	4.17	5.29	5.12
Method error (Dahlbergh formula)	0.21	0.22	0.21

TABLE 2: COMPARISON OF GONIAL ANGLE MEASURED FROM LATERAL CEPHALOGRAM AND OPG

		Mean	+SD	P value
Pair 1	Lateral cephalogram – OPG Right	2.112	3.277	0.029*
Pair 2	Lateral cephalogram - OPG Left	1.402	3.723	0.002*
Pair 3	OPG Right - OPG Left	0.612	4.510	0.135

\* = Significant difference

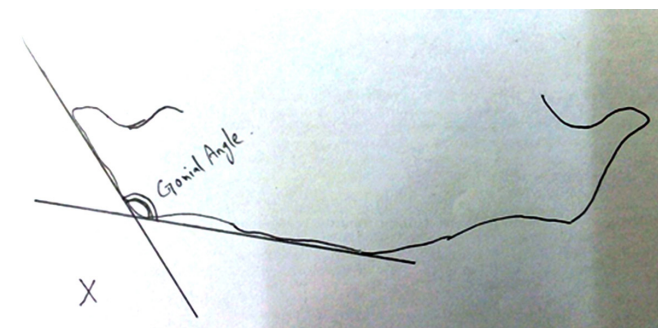


Fig 1: Gonial angle tracing on a Panoramic radiograph

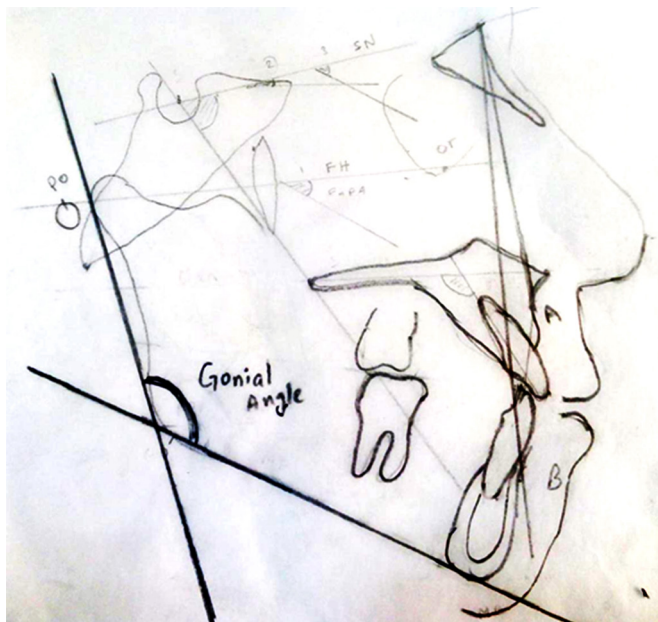


Fig 2: Gonial angle tracing on a Lateral Cephalogram

in routine clinical practice. Some studies conducted earlier to find out this objective found no significant difference between gonial angle values measured from panoramic radiographs and those determined from lateral cephalometric images.<sup>16,17</sup> but in contrast to these previous studies, our study shows different results. This study is in shows the similar results to the study conducted by Bhullarin 2014, showing same measurement obtained from right and left side of OPG.<sup>18</sup>

Some studies confirmed the clinical application of panoramic radiographs for measuring the gonial angle, since there is no superimposition on the left and right sides of gonial angles on panoramic radiographs.<sup>9, 18-20</sup> Another study determined the values of gonial angle on cephalograms, panoramic radiographs and dried skulls. They found out that values for right and left sides gonial angles obtained from OPG were same to the values determined on dry skulls. They also found that the means of the values obtained from lateral cephalograms were less accurate than the values obtained from OPG panoramic when they were compared to gonial angle measured on the dry mandible.<sup>15</sup>

Araki et al<sup>21</sup> conducted another study to compare gonial angles measured from OPG with the values of angle on lateral cephalometric radiographs measured from 2 dry mandibles. They found that the lateral cephalometric radiographs showed larger values of gonial angle than the values obtained from OPG.

In another study vertical facial and dentoalveolar changes as measured on panoramic and lateral cephalometric radiographs were compared. The study concluded the less accuracy of panoramic radiographs in determining the vertical facial dimension but they stated that angular values from OPG are more accurate than vertical values as in OPG there is less image distortion in the lateral and posterior aspects of the mandible.<sup>22</sup> The current study, is in agreement with the previous study as they found no statistical difference between the right and left gonial angles in the panoramic radiograph ( $P = 0.712$ ).<sup>15</sup> Katti and Kumar et al study also proved that OPG can be used to determine the gonial angle and ramus height as reliably as a lateral cephalometric radiograph.<sup>23,24</sup>

Fisher-Brandies et al found that gonial angle value measured from OPG was 2.2–3.6° less than the values obtained from lateral cephalometric radiograph. They obtained significant differences in the gonial angle values by the two different radiographs and this is in agreement to the results of our study.<sup>25</sup>

Katti G et al found different results from their study on 100 patients. The results of the study showed that OPG can be used to measure the gonial angle as reliably as lateral cephalogram. Their study further suggested that OPG can be used for measuring the right and left gonial angles as it is a simple, less expensive than lateral cephalogram and routinely practiced radiologic technique.<sup>23</sup> This difference in the results from our study could be due to selection of different malocclusion type and age of the patients which were not specified in the above mentioned study, while the present study was performed in adults with Class I malocclusion. The other reason of the different results could be due to our small sample size than that study and the reliability and strength of our study would have been increased if this study was conducted on a larger sample size.

## CONCLUSION

When gonial angle values obtained from both sides of OPG were compared, no statistically significant difference was found. Significant differences were found when gonial angle values obtained from OPG right and left sides were compared with were compared with that of lateral cephalogram. Therefore, gonial angle cannot be measured on OPG as precisely as lateral cephalometric radiograph.

**Limitations of the study**

Errors in identification of landmarks on lateral cephalogram which could result in errors during tracing resulting in decreased reliability of cephalometric radiograph.

Male and female sample size was not equal as we received more number of male patients than female patients. (50 male and 35 female).

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