

# Comparison between the external gonial angle in panoramic radiographs and lateral cephalograms of adult patients with Class I malocclusion

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**Abstract:** The external 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. In this study, we compared the external gonial angle determined from the two mentioned radiographs in Class I patients. We collected the radiographs of 70 patients with Angle's Class I (22 men and 48 women). The patients' age ranged from 15-30 years with a mean age of 18.24 years. The data gained were statistically evaluated by *t*-test. The following results were obtained. The mean value of the gonial angle in the lateral cephalogram was 125.00° (men, 124.9° and women, 125.04°) and in the orthopantomogram was 124.17° (men 123.68°, women 124.39°). The difference between these rates was 0.83° (men 1.22°, women 0.64°) and not significant ( $P = 0.406$ ). Based on the obtained results, we can conclude that panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram. In addition, we can determine the right and left gonial angles of a patient in the orthopantomogram without interferences due to superimposed images of anatomical structures in a lateral cephalogram. For determination of the gonial angle, an orthopantomogram may be a

better choice than a lateral cephalogram. (J Oral Sci 51, 425-429, 2009)

Keywords: lateral cephalogram; orthopantomogram; external gonial angle.

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## Introduction

Panoramic radiography was introduced for the first time by Professor Yrjö Paatero of the University of Helsinki in 1961 (1). It is frequently used in orthodontic practice to provide important information about the teeth, their axial inclinations, maturation periods, and surrounding tissues (2-5).

Lateral and anteroposterior projections are mostly used when cephalometric measurements are made from radiographs. However, because of the interference of superimposed images appearing on the lateral cephalograms, reliable measurements of the individual gonial angles become very difficult, particularly when planning any type of jaw surgery. This disadvantage is not encountered in orthopantomography which is being used increasingly for jaw examination (6). Although some investigators showed that the size of the gonial angle can be determined from the orthopantomogram with the same degree of accuracy as from the generally used lateral cephalogram (6), others stated that there was a great individual variation in gonial angle distortion and showed that the gonial angle differs by age and in different types of malocclusion (7-10). German and French investigators first recorded the measurements at the end of the nineteenth

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Table 1 Mean, maximum, minimum and standard deviation of cephalometric variables

Variable	Mean	Maximum	Minimum	Standard Deviation
SNA	81.51	85	76	3.57
SNB	78.77	84	74	3.25
ANB	2.74	4	0	1.55
FMA	27.39	35	22	5.62
Facial Angle	84.24	91	81	3.97
Wits (mm)	2.09	3	0	0.94

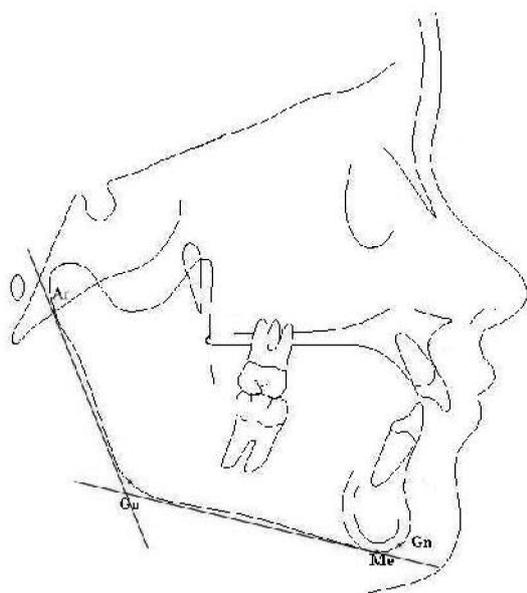


Fig. 1 External gonial angle in lateral cephalogram.

century. It was shown that the average mandibular angle did not change from the time one reached adulthood to at least 70 years of age, except when there was extensive tooth loss (11). Fischer-Brandies et al. stated that in determining the gonial angle, the lateral cephalometric radiograph is preferred (12). However, Larheim and Svanaes indicated that lateral cephalograms did not permit reliable registration of the gonial angle, and the superimposed images created difficulties in recognition and measurement of the individual angles, whereas the gonial angle assessed from a panoramic film was almost identical to that measured on the dried mandible (13). Since the gonial angle can be determined more easily in an orthopantomogram than in a lateral

cephalogram, we decided to compare the accuracy of gonial angle measures obtained from the two types of radiographs. The aim of this study was to identify and determine the radiography appropriate for gonial angle measurement.

### Materials and Methods

For this study, the lateral cephalograms and orthopantomograms of 70 former orthodontic patients (48 females and 22 males) were selected. They were aged 15-30 years with a mean age of 18.24 years (standard deviation 2.99 years). All the selected patients had been treated at the Orthodontics Department of Mashhad Dental School. The criteria for selection of patients' radiographs were as follows: the radiographs had to be of high quality and sharpness, and all radiographs had to be taken by the same apparatus and in natural head position (NHP). All the selected patients had skeletal class I malocclusion.

The selected radiographs were traced onto a sheet of cellulose acetate by one operator using a 2H pencil. Cephalometric landmarks were located, identified, and marked. The lines and angles were drawn and measured using a cephalometric protractor and calipers. Measurement error was determined by remeasuring the cephalometric parameters. SNA, SNB, ANB, FMA, and facial angles were then measured and Wits analysis was performed for all samples to confirm that all patients had Class I malocclusion (Table 1).

In lateral cephalograms, mandibular and ramal planes were drawn and based on these planes, and gonial angle was determined (Fig. 1). In panoramic radiographs, the gonial angle was determined from two tangents which were drawn from the inferior border of the mandible and posterior borders of condyle and ramus of both sides (Fig. 2).

Table 2 Mean, standard deviation, and range of gonial angle in lateral cephalogram and OPG in degrees

Variables	Mean	Standard Deviation	Range
Gonial angle in cephalogram	125.00	5.87	110-140
Gonial angle in OPG	124.17	5.88	113.5-138
Right gonial angle in OPG	123.94	6.20	110-138
Left gonial angle in OPG	124.40	5.88	110-139

Statistically significant differences between variables were evaluated with the Student *t*-test and regression analysis. These analyses were performed using the SPSS (version 11.5, Chicago, IL), with a probability level of  $P < 0.05$  considered to be statistically significant.

### Results

The mean value of the gonial angle in lateral cephalograms was  $125.00^\circ$  with a standard deviation of  $5.87^\circ$ . The gonial angle in females was  $125.04^\circ$  and that in males  $124.90^\circ$  with no statistically significant difference between the two genders. The mean value of the gonial angle in panoramic radiographs was  $124.17^\circ$  with a standard deviation of  $5.88^\circ$ . The gonial angle in females was  $124.39^\circ$  and that in males  $123.68^\circ$  with no statistically significant difference between the two genders. In panoramic radiographs, the mean value of the right gonial angle was  $123.94^\circ$  with a standard deviation of  $6.20^\circ$  and the mean value of the left gonial angle was  $124.40^\circ$  with a standard deviation of  $5.88^\circ$  (Table 2). According to Table 2, there were no significant differences between the values of gonial angles determined by lateral cephalogram and panoramic radiography ( $P = 0.406$ ). Also, in panoramic radiography, there was no significant difference between the right and left gonial angles ( $P = 0.670$ ).

Based on the results of the present study, the difference between the mean gonial angle in lateral cephalogram and panoramic radiography was  $0.65^\circ$  in females and  $1.22^\circ$  in males and the difference between males and females was  $0.57^\circ$ . As  $P > 0.05$  for all the variables mentioned above, these differences were not significant. Furthermore, linear regression analysis showed a significant correlation between the means of gonial angle in OPG and lateral cephalometry ( $r = 0.562$ ,  $P < 0.05$ ) (Fig. 3).

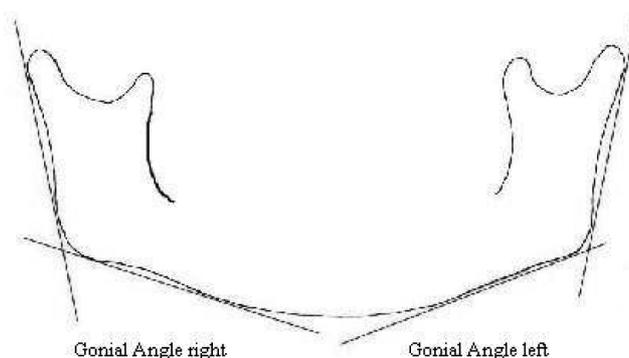


Fig. 2 External gonial angle in orthopantomogram.

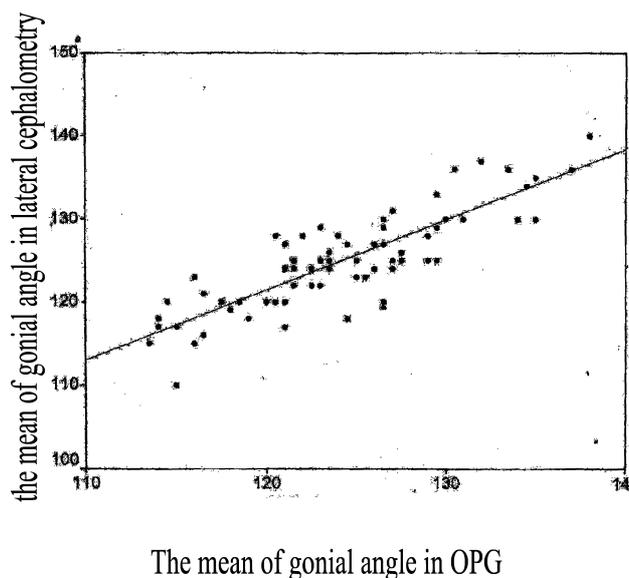


Fig. 3 Correlation coefficient and linear regression between the means of gonial angle determined from the OPG and lateral cephalogram.

Table 3 *P*-values related to comparison of gonial angle in lateral cephalogram and OPG

Variables	Mean differences (in degrees)	<i>P</i> -value
Gonial angle in cephalogram and OPG	0.83	0.406
Right and left gonial angle in OPG	0.46	0.670
Gonial angle in cephalogram and OPG (males)	1.22	0.489
Gonial angle in cephalogram and OPG (females)	0.64	0.596
Right gonial angle in OPG and cephalogram	1.05	0.302
Left gonial angle in OPG and cephalogram	0.60	0.565

### Discussion

This study was performed to assess and compare the measurement of gonial angle from panoramic radiographs and lateral cephalograms in adult patients with Class I malocclusion of mean age 18.24 years.

In the present study, the mean values of external gonial angle were 124.17° and 125.00° in the panoramic radiograph and lateral cephalogram, respectively, with no significant difference between the two radiographs ( $P = 0.406$ ). Mattila reported a gonial angle of 127.8° in the panoramic radiograph and 128.6° in the lateral cephalogram. Although both means were greater than those of the present study, the difference between the two means in his study was also insignificant (6). Larheim and Svanaes also stated that both panoramic radiographs and lateral cephalograms were accurate in determining the gonial angle and there was no significant difference between the right and left sides in panoramic radiography (13).

Fisher-Brandies et al. indicated that the gonial angle obtained by panoramic radiography was 2.2-3.6 degrees less than that of lateral cephalogram. They observed significant differences in the gonial angle obtained by the two different radiographs, which was in contrast to the results reported in this study. The disparity in the results could be because the type of malocclusion and age of the samples was not specified in the abovementioned study, while the present study was performed in adults with Class I malocclusion (12).

In our study, there was no statistical difference between the right and left gonial angles in the panoramic radiograph ( $P = 0.670$ ), which coincided with the results of previous studies (6,8). We failed to find any statistically significant gender differences in the gonial angle determined from the two different types of radiographs, which was in agreement

with the results reported by Altonen (8). Ohm claimed that the gender had little effect on the size of the gonial angle (14). Akcam et al. stated that even though panoramic radiographs provide information on the vertical dimensions of craniofacial structures, clinicians should be vigilant when predicting skeletal cephalometric parameters from panoramic radiographs, because of their lower predictability. This is contrary to what other researchers believe (5).

The result of this study showed that there were no significant differences between the mean values of the external gonial angle in the panoramic radiograph and lateral cephalogram (0.83°) and the mean values of the right and left gonial angles in panoramic radiographs (0.46°). According to *t*-test, there were no significant differences between panoramic radiographs and lateral cephalogram methods in determination of the gonial angle. In addition, gender did not have a considerable effect on the gonial angle in both radiographs. It may be concluded that panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram. Furthermore, in panoramic radiography the right and left gonial angles can be measured easily without superimposition of anatomic landmarks, which occurs frequently in a lateral cephalogram.

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