

ORIGINAL ARTICLE

COMPARISON OF GONIAL ANGLE BETWEEN PANORAMIC RADIOGRAPHS AND LATERAL CEPHALOGRAMS IN DIFFERENT SAGITTAL FACIAL PATTERNS

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ABSTRACT

Background: Gonial angle is extensively used in orthodontics for the diagnosis of the growth pattern. Lateral cephalograms and panoramic radiographs both can be used to assess this angle. The aim of the study was to compare gonial angle measured from the panoramic radiograph and lateral cephalogram in different sagittal facial patterns.

Methods: A comparative cross-sectional study was conducted at the Department of Orthodontics, Ziauddin College of dentistry, Karachi, from January, 2017 to August, 2017. A total of 140 subjects (60 males and 80 females) with ages ranging from 12 to 39 years were included. Sample was further divided into two groups according to their sagittal skeletal pattern, depending upon the angle formed by ANB on lateral cephalogram: i.e; Skeletal Class I: ANB 0-4° and Skeletal Class II with ANB > 4°. Gonial angle was measured on pre-treatment panoramic radiograph and lateral cephalograms of orthodontic patients. Pearson's correlation coefficient was used to see the degree of correlation of gonial angle between panoramic radiograph and lateral cephalogram. Independent sample t-test was used to find difference in gonial angle between panoramic radiograph and lateral cephalogram in different sagittal facial patterns.

Results: Mean age of male patients was 15.3±1.3 years and female patients 15.4±0.8 years, respectively. There was no statistically significant difference found in gonial angle measured on panoramic radiograph and lateral cephalogram.

Conclusion: Panoramic radiography can be used as an alternative to lateral cephalogram to assess the gonial angle in different sagittal facial patterns.

KEYWORDS: Gonial angle, Sagittal facial patterns, Panoramic radiograph and Lateral cephalogram

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INTRODUCTION

Orthodontic diagnosis and treatment planning depends on data derived from diagnostic aids such as clinical examinations, study models, and the relevant radiographs such as panoramic radiograph and lateral cephalogram.¹

Panoramic radiography was first developed in 1961 by Professor Yrjö Paatero.² It provides important

information regarding teeth, their axial inclinations and stages of maturation and surrounding structures (e.g. TMJ).³⁻⁸ Cephalometric radiography was introduced by Hofrath in Germany and Broadben in USA in 1934. It provides information about skeletal, dental and soft tissues.¹

Gonial angle gives the demonstration of the form of the mandible. This angle is one of the most important parameter required for orthodontic and orthog-

nathic surgical diagnosis and treatment planning. Furthermore, it is a valuable indicator for predicting the growth pattern, rotation of mandible, profile changes and the condition of the anterior teeth of the lower jaw. It also helps in deciding the extraction pattern in Class II patients and in evaluating the facial symmetry. In addition to this, it is also used for estimating age in forensic medicine.^{3,4}

Different investigators have preferred lateral cephalogram for measuring gonial angle.⁹⁻¹⁰ However, various other studies observed that the correctness of measurements of the gonial angle using lateral cephalogram is questionable, because of the superimposition of the right and the left angles.¹¹⁻¹² Panoramic radiograph is routinely requested by dentists during dental examination. Different studies have also been conducted using panoramic radiographs in evaluating dentoskeletal condition and gonial angle measurements, with the conclusion that gonial angle can be measured on the panoramic radiograph without any superimposition and thus can be used by orthodontist to timely detect growth problems.¹³⁻¹⁵

Globally, many studies have been conducted to assess accuracy of panoramic radiograph for measuring the gonial angle; however limited data is available in our country. Therefore, need arises for such studies to be carried out on Pakistani population, which can help an orthodontist especially during diagnosis and treatment planning.

The aim of this study was to compare gonial angle measured from the panoramic radiograph and lateral cephalogram in different sagittal facial patterns.

METHODS

A comparative cross-sectional study was conducted using pre-treatment panoramic radiograph and lateral cephalogram of patients who visited the Orthodontics department, from January, 2017 to August, 2017. Inclusion criteria were subjects of Pakistani origin, aged between 12 to 39 years with no prior history of orthodontic treatment. Patients with previous history of surgeries, trauma or syndromes affecting the jaws were excluded from this study. All radiographs were taken in the Radiology Department of Ziauddin Hospital Clifton, Karachi. As per departmental protocol, an informed written consent was obtained from all the subjects prior to inclusion in this study.

National Council for Social Studies, Powerful and Authentic Social Studies (NCSS PASS 2007) was used to calculate the sample size using means and standard deviations from a pilot study done by the principal investigator on a sample of 60 subjects (30 in each sagittal group i.e. skeletal Class I and skeletal Class II). Reference

The total sample of 140 subjects was divided into two equal groups according to their sagittal skeletal pattern, depending upon the angle formed by ANB on lateral cephalogram: i.e; skeletal Class I: ANB=0-4° and skeletal Class II: ANB > 4°. Gonial angle was calculated from the intersection of two planes, i.e; plane of the ramus of the mandible and body of the mandible on both radiographs (Figure 1 and 2).



Figure 1: Construction of Gonial angle on Panoramic radiograph

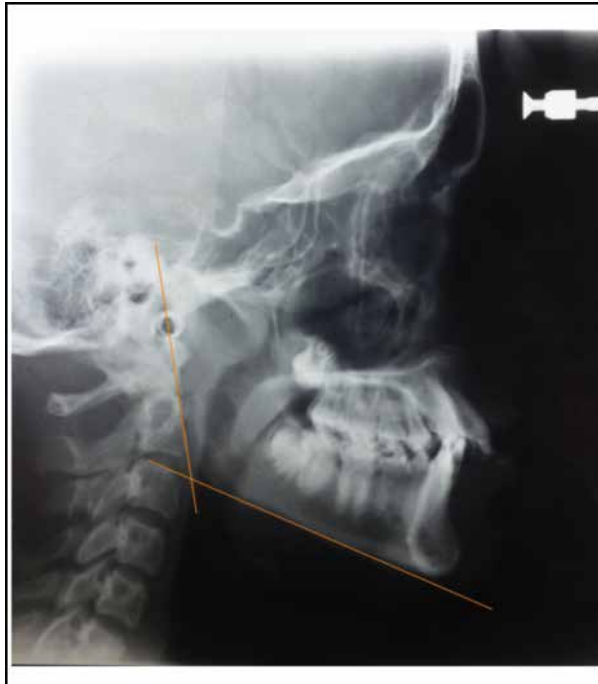


Figure 2: Construction of Gonial angle on Lateral Cephalogram

All the data was then subjected to statistical analysis using SPSS for windows (version 20.0). Pearson's correlation coefficient was used to see the degree of correlation of gonial angle between panoramic radiograph and lateral cephalogram. Independent sample t-test was used to see the difference in gonial angle in different sagittal facial patterns. P-value of ≤ 0.05 was considered to be significant. To rule out measurement error, 20 panoramic radiograph and lateral cephalograms were re-traced by the principal researcher after one month. Paired samples t-test was used to find the measurement error for the ANB value and gonial angle.

RESULTS

A total of 140 subjects (60males, 80 females) were divided into two equal groups according to their sagittal skeletal pattern: i.e. Skeletal Class I(70 subjects) and Skeletal Class II(70 subjects). Mean age of males was 15.3 ± 1.3 years and females was 15.4 ± 0.8 years.

Pearson's correlation coefficient was used to see the degree of correlation of gonial angle between OPG and on lateral cephalogram. A strong correlation was found between the values taken on both the radiographs ($r=0.912$) as depicted in Table 1.

Table 1: Correlation between Panoramic and Cephalometric Radiographs for Measurement of theGonial Angle

Variable	Pearson Correlation
Panoramic Radiograph and Lateral Cephalometric Radiograph	0.912**

**Correlation is significant at the 0.01 level (2-tailed)

The mean value of the gonial angle on the lateral cephalogram was 124.14 ± 7.62 o and that on the panoramic radiograph was 123.98 ± 7.35 o in Skeletal Class I subjects. In Skeletal Class II subjects, the mean value of the gonial angle on the lateral cephalogram was $124.74\pm 7.26^\circ$ and that on the panoramic radiograph was $124.05\pm 7.62^\circ$. Independent sample t-test, used for comparison of gonial angle in different sagittal facial patterns,was statistically insignificant(Table 2).

Table 2: Gonial Angle Measured using Panoramic Radiographs and Lateral Cephalograms in Various Sagittal Facial Patterns

Sagittal Facial Pattern	Mean \pm SD Panoramic Radiograph	P-value	Mean \pm SD Lateral Cephalometric Radiograph	P-value
Skeletal Class I	123.98 ± 7.35	0.590	124.14 ± 7.62	0.881
Skeletal Class II	124.05 ± 7.62		124.74 ± 7.26	

Level of significance 0.05; SD: Standard Deviation.

The results of paired t-test showed statistically insignificant difference amongst the first and the second set of readings for gonial angle($p=0.079$) and ANB ($p=0.786$), thus giving a good intra-examiner reliability for these measurements.

DISCUSSION

Panoramic and Lateral Cephalometric Radiographs were compared for measuring the gonial angle in the present study and a strong correlation was seen between the two radiographs. Bibi et al in their study also found significant correlation between lateral cephalometric radiographs and panoramic radiographs ($p<0.01$). They concluded that panoramic radiograph is reliable and reproducible and thus can be used as an alternative to lateral cephalometric radiograph.¹⁶

Various studies have measured gonial angle and compared it onlateral cephalograms versus

panoramic radiographs.¹²⁻¹⁵ Chalipa and his coworkers declared that panoramic radiographs could be used to measure the gonial angle interpreting patient's growth pattern¹⁷. Shahabi and Zangouei-Booshehri also found similar results in their study.^{13,18} Shahabi et al¹³ compared the external gonial angle between panoramic radiographs and lateral cephalograms in adult patients with Class I malocclusion. They reported that panoramic radiography can be used to assess the gonial angle as accurately as a lateral cephalogram. Fatahi and Babouei¹⁹ evaluated the reliability of the cephalometric measurements determined from an OPG. They compared actual measurements obtained from dry skulls and panoramic radiographic measurements and found highest correlation between panoramic and cephalometric radiographs in gonial angle.¹⁹

In contrast to our study, Akcam et al⁶ concluded 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 percentages. Fisher-Brandies²⁰ found gonial angle on panoramic radiograph 2.2–3.6 degrees less than lateral cephalograms and their study results showed significant difference between the two radiographs. The results of this study are contradictory to the results obtained by Fisher-Brandies. This difference in results could be because of the difference in the type of malocclusion and age of the subjects. The results of our study are also contradictory to the study done by Nohadani et al.²¹ They compared longitudinal vertical facial and dentoalveolar changes using panoramic radiographs with measurements on lateral cephalometric radiographs and reported that panoramic dental radiographs are not useful for evaluating vertical facial parameter changes during time.

CONCLUSION

Comparison of the two radiographic techniques in different sagittal patterns in the present study indicate that panoramic radiographs can be used for measuring the gonial angle with good accuracy as lateral cephalogram.

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