

Comparison of Accuracy of Gonial Angle of Orthopantomogram and Lateral Cephalogram for Mandibular Measurements among Orthodontic Patients Attending Tertiary Care Dental Hospital in Kathmandu.

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ABSTRACT

Introduction: Gonial angle is an important parameter of the craniofacial complex which is generally used to evaluate the vertical parameters and symmetry of the facial skeleton. Gonial angle can be measured in both orthopantomogram (OPG) and lateral cephalograms. Due to the superimpositions seen while measuring the bilateral structure on lateral cephalograms, reliable measurement of the gonial angle becomes difficult. This study is done to clarify the possible application of orthopantomogram (OPG) for evaluating angular measurement of the mandible specifically gonial angle by comparing with lateral cephalogram.

Materials and Method: All the patients (104) being treated from January 2018 to August 2020 in department of Orthodontics in Nepal Medical College were included in the study. Gonial angle measurements were made on lateral cephalograms and orthopantomograms of 104 patients – 54 males and 50 females with mean age of 22.20 ± 3.25 years. Patients aged 15-35 years were included in the study. Data was processed in SPSS version 16.0.

Result: Mean Gonial angle in lateral cephalogram was greater than mean gonial angle in OPG and this difference was found to be statistically significant (p -value < 0.05). The difference in mean gonial angle was found to be statistically significant when compared between right gonial angle in OPG and gonial angle in lateral cephalogram (p -value < 0.05) and also between left gonial angle in OPG and gonial angle in lateral cephalogram (p -value < 0.05).

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 that of lateral cephalogram.

KEYWORDS: Gonial angle, Lateral cephalometric radiograph, Orthopantomogram

INTRODUCTION

Orthodontic diagnosis and treatment planning involves set of detailed study of dental occlusion, hard tissue relationships and soft tissue proportions.¹ History, clinical examination and evaluation of diagnostic records including dental casts, radiographs and photographs, cephalograms and orthopantomogram (OPG) are routinely taken for every orthodontic patient.^{2,3,4} Generally cephalometric analysis is done to evaluate the horizontal and vertical relationship of five major functional components of the face: The cranium and cranial base,

skeletal maxilla, skeletal mandible, the maxillary dentition and alveolar process and the mandibular dentition and alveolar process.^{5,6}

The vertical and horizontal relationship of these structures are equally important, as the treatment plan as well as the outcome is affected by the vertical relationships and the growth pattern of the patient. The external gonial angle is an important angle of the craniofacial complex. It plays vital role in diagnosing craniofacial disorders. Gonial angle is one of the important parameters giving an indication

about the vertical parameters and symmetry of the facial skeleton. The gonial angle is measured by taking the tangent to the posterior border of the ramus and tangent to the lower border of the mandible on lateral cephalogram.^{6,7}

Gonion is one of the derived landmark that is formed by bisecting the angle formed by lines tangent to the posterior border of the ramus and inferior border of the mandible or mandibular plane.⁷ The gonial angle also referred as the mandibular angle is the angle formed by these two above mentioned tangents.⁸ There is a little disagreement between orthodontic analysts on the determination of mandibular plane. Depending on these differences, three of the most commonly constructed mandibular planes are:

- Down's: line connecting Gonion(GO) and Menton(Mn)⁹
- Steiner's: line connecting Gonion(GO) and Gnathion(Gn)¹⁰

Reliable measurement of the gonial angle might be difficult in lateral cephalogram due to the superimposition.¹¹ Panoramic radiography is frequently used in orthodontic practice to provide important information about the teeth, their axial inclinations, maturation periods and surrounding tissues. Due to the versatile ability to take a single picture of the entire stomatognathic system-teeth, jaws, temporomandibular joints, sinuses-panoramic radiography forms an indispensable orthodontic screening tool. There are limited studies examining panoramic radiographs as a means of investigating skeletal patterns in the orthodontic literature. OPG, which is also used as an essential diagnostic aid, can be an excellent choice for measurement of the gonial angle as there is no complication of superimposed images appearing as in cephalogram.¹¹

This study is performed to compare both the angular measurement between OPG and lateral cephalogram in randomly selected samples. There are only a few reported studies comparing angular mandibular measurements between OPG and lateral cephalogram in Nepalese population.

MATERIALS AND METHOD

All the patients (104) being treated at the department of Orthodontics in Nepal Medical College were included in the study by convenient sampling technique. Gonial angle measurements were made on lateral cephalograms and orthopantomograms of 104 patients – 54 males and 50 females with mean age 22.20 ± 3.25 years (Fig 1).

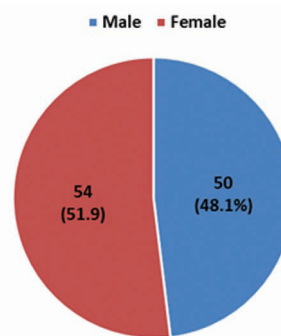


Figure 1: Gender wise distribution of study participants

Inclusion Criteria:

- Patients aged 15-35 years were included in the study
- All the radiographs selected were of high quality and sharpness and were taken by the same apparatus with standard exposure conditions and in the Natural Head Position.

Exclusion Criteria:

- Patients with craniofacial syndromes and facial asymmetry.

Data was processed in SPSS version 16.0 (IBM USA). Tracing were done by Orthodontist involved in the study on panoramic radiograph and lateral cephalometric radiograph of the patients (Fig 2,3).



Figure 2: Tracing of gonial angle done in OPG

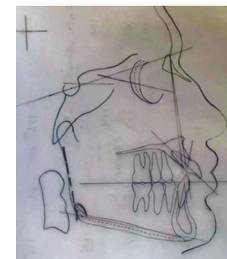


Figure 3: Tracing of gonial angle done in Lateral cephalogram

The tangents were drawn with a 2H pencil. The gonial angle was measured between two lines. One tangent was drawn to the distal border of the ascending ramus and condyle and the second to the lower border of the mandible on both OPG and lateral cephalogram. Ethical clearance was taken from Institutional Review Committee (NMC-IRC), Nepal Medical College. Data was entered in excel and exported to SPSS version 17 for further analysis. Data were presented in the form of frequency, percentage, mean and standard deviation. Paired t-test was done to find the mean difference in gonial angle between right

and left OPG and between mean value of OPG and lateral cephalogram.

RESULTS

A total of 104 study participants were included in the study of which 54(51.9%) were male and 50 (48.1%) were female (Fig 1). Mean age of the study sample was 22.20 ± 3.25 years. Mean values of gonial angle measured from lateral cephalometric radiograph were 118.35 + 5.57 degrees whereas when measured from Orthopantomogram, it was 117.42 + 4.83 and 117.30+ 4.88 degrees for right and left respectively (Table 1). Gonial angle measured on both right and left side of OPG were significantly different

than lateral ceph measurements whereas difference between gonial angles of both sides of OPG was found to be non-significant (Table 1). There is no statistically significant difference in mean right and left gonial angles in OPG (p-value = 0.247, Table 2). Mean Gonial angle in lateral cephalogram was greater than mean gonial angle in OPG and this difference was found to be statistically significant (p-value < 0.05). The difference in mean gonial angle was found to be statistically significant when compared between right gonial angle in OPG and gonial angle in lateral cephalogram (p-value < 0.05) and also between left gonial angle in OPG and gonial angle in lateral cephalogram (p-value < 0.05, Table 3)

Table 1: Descriptive statistics of gonial angle in lateral cephalogram and panoramic radiographs in degrees

Variables	Mean	Standard Deviation	Range
Gonial angle in cephalogram	118.35	5.57	108-129
Right gonial angle in OPG	117.42	4.83	107-127
Left gonial angle in OPG	117.30	4.88	107-126
Mean Gonial angle in OPG	117.36	4.82	107.5-126.5

Table 2: Comparison of mean difference in right and left gonial angles in OPG

Variables	Mean angle	Mean difference	t-value	95% Confidence Interval		p-value
				Lower Bound	Upper Bound	
Right gonial angle	117.42	0.12	1.165	-0.088	0.338	0.247
Left gonial angle	117.30					

Table 3: Comparison of mean difference in gonial angles in OPG and lateral cephalogram

Variables		Mea gonial angle	Mean difference	t-value	95% Confidence Interval		p-value
					Lower Bound	Upper Bound	
Pair 1	OPG	117.36	0.99	3.869	0.480	1.491	<0.05*
	Lateral cephalogram	118.35					
Pair 2	Right OPG	117.42	0.93	3.602	0.415	1.431	<0.05*
	Lateral Cephalogram	118.35					
Pair 3	Left OPG	117.30	1.05	3.964	0.524	1.572	<0.05*
	Lateral Cephalogram	118.35					

Paired t-test p-value < 0.05 statistically significant*

DISCUSSION

The objective of this study was to understand the panoramic radiograph's potential to be used in evaluating craniofacial specifications. There is limited number of studies performed on gonial angle in Nepalese population. The results of the study show that there are statistically significant differences in the values of gonial angle measured on cephalogram and OPG. The study done by Zangouei et al¹² has contradicting evidence regarding Gonial angle values ascertained on lateral ceph tracing and OPG x-ray. However, the present study is in agreement to the study done by Bhullar et al¹³ which describe the values of both sides of the OPG to be identical. The result of this study denotes that previous studies must be looked at with caution since radiological standardization, based on technical as well as human errors is prevalent in many clinical settings. This may also be the cause of difference in the reported results.

Despite having such evidence, gonial angle measured on OPG has been proved to be closer to the value measured on dry human mandibles.¹¹ We might conclude that Gonial angle can be preferentially measured on OPG rather than lateral Ceph tracing. Due to lack of overlap of anatomical structures, measurement of gonial angle on OPG might be more desirable.

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 values measured from lateral cephalograms. To accurately determine the changes after orthodontic treatment, measurement of the gonial angle on the right and left sides of OPG make it possible.¹⁴ 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.¹⁵

Mattila et al.¹³ in 1971 took measurements of gonial angle on cephalograms, panoramic radiographs and dried skulls. They reported that right and left gonial angles from panoramic images were equal to the angles measured on dry skulls. Fischer-Brandies et al.¹⁶ stated that in determining the gonial angle, the lateral cephalometric radiograph is preferred. However, Larheim and Svanae¹⁴ 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. Study done by Akcam et al.¹⁷ compared angular measurements on the OPG to angular measurements on the cephalogram found that the OPG can provide information on angular and vertical dimensions of the cranio-facial structures, but that it is not as reliable as a lateral cephalogram. Another study done for comparing the external gonial angle by Shahabi et al.¹⁸ from the lateral cephalograms and panoramic radiographs in Class I patients concluded that panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram.

Study done by Araki et al.¹⁹ concluded that the gonial angle measurements were slightly smaller on the panoramic radiographs than on the lateral cephalometric radiographs. Ibad and Muhammad²⁰ concluded that the gonial angle measured from both sides (left and right) of OPG is equally reliable but significantly different than gonial angle measured from lateral ceph. Similar results were found in study done by Shabar et al²¹, indicating this phenomenon must be further tested on a larger scale to establish the fact whether OPG can be used as a more reliable tool for the assessment of gonial angle instead of measuring the same on a lateral ceph.

Study done by Fatahi and Babouei²² for evaluating the reliability of the cephalometric measurements when determined from an OPG compared the actual measurements obtained from dry skulls and panoramic radiographic, the measurements revealed highest correlation between panoramic and cephalometric radiographs in gonial angle, whereas the least correlation was seen in the length of the mandibular body.

Kurt et al.²³ used OPGs to evaluate mandibular asymmetry in Class II subdivision malocclusion patients by measuring condylar, ramal, condylar and ramal asymmetry index values and gonial angle measurements. They concluded that acceptable results can be achieved with panoramic radiographs.

CONCLUSION

This study concludes that the gonial angle measured from OPG of the patient is significantly different than that of the lateral cephalogram measurement. Further studies on larger scale needs to be done to establish the fact whether OPG can be used as a more reliable tool for the assessment of gonial angle instead of measuring the same on a lateral ceph.

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