

# Comparison of Gonial Angle on Lateral Cephalogram and Orthopantomogram in Class I Class II and Class III Cases- A Cross Sectional Study.

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## ABSTRACT

**Background:** Gonial angle is important parameter in orthodontics for determining the growth pattern i.e, vertical growers or horizontal growers, estimating the age and surgical decision in class III skeletal patients. The purpose of this study was to ensure the reliability of gonial angle in various classes of sagittal mal occlusion in orthopantomogram(OPG) verses lateral cephalogram. **Materials and methods:** A cross sectional study carried out in the Department of Orthodontics and dentofacial orthopaedics Govt dental college Srinagar. The study included the pretreatment records of the cases undergoing orthodontic treatment in the department with 90 subjects divided into three groups viz (Gr1-30 subjects of Class I, Gr 2, 30 subjects of ClassII and Gr 3, 30 subjects of Class III cases) in the age range of 12-30 years. **Results:** Reliability of gonial angle was assessed in orthopantomogram (OPG) in comparison with lateral cephalogram and was found highly correlated to each other and differences exhibiting statistically not significant. **Conclusion:** The study concluded that the gonial angle in orthopantomogram in classI, ClassII, and Class III cases could be as reliable as found in lateral cephalogram.

**Keywords:** Gonial Angle, Lateral Cephalogram, Orthopantomogram.

## INTRODUCTION

Gonial angle is considered to be an important parameter in orthodontics for determining the growth pattern of patients i.e, vertical growers or horizontal growers and in estimating the age of individuals.<sup>[1,9]</sup> Gonial angle is usually measured on lateral cephalograms showing its accuracy ,reproducibility supported by baumrind and Frantz(1971) and Houston (1983).<sup>[2,3]</sup> However several studies including larhen and svanaues have questioned the accuracy of measuring gonial angle in lateral cephalogram because of super imposition of left and right gonial angles.<sup>[9]</sup> Panoramic radiography can be used to assess the gonial angle more accurately than lateral cephalography without any superimposition error.<sup>[5]</sup> This study was done to compare the gonial angles in Class I, Class II and Class III subjects, therefore the aim of this study was to evaluate whether the gonial angle accuracy in orthopantomogram is reliable in all

sagittal malocclusion in comparison with lateral cephalogramgonial angles in Kashmiri population.

## MATERIALS AND METHODS

This cross sectional study was carried out in the Department of Orthodontics and dentofacial orthopaedics Govt dental college Srinagar in northern india. The study was conducted on the pretreatment records of the cases undergoing orthodontic treatment in the department. A total of 90 subjects were selected for the study which were divided into three groups viz (Gr 1-30 subjects of Class I, Gr 2 30 subjects of Class II and Gr 3 30 subjects of Class III cases) in the age group of 12-30 years. The inclusion criteria includes pre-treatment radiographs of subject who had reported for orthodontic treatment with complete compliment of dentition and no facial deformity. The subjects with a previous history of orthodontic treatment ,cleft lip and palate, facial or mandibular surgery or syndromes affecting jaw or face were excluded from the study.

All the 90 cases consented to be exposed for lateral cephalogram and orthopantomogram by the same operator with same machine (New Tom GIANO).

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Various parameters were selected for the segregation of Class I, Class II, and Class III and the mean of gonial angle in each class of malocclusion was listed in [Table 1].

Tracing of orthopantomogram and Lateral Cephalogram were done by the same operator using 3H pencil and was rechecked by another operator to remove the measurement error. In lateral cephalogram Mandibular and ramal planes

were drawn to determine gonial angle. The gonial angle measured in a lateral cephalogram is geometrically an intermediate angle between the right and the left gonial angle. Arithmetically, it is the mean, similarly in orthopantomogram two tangents were drawn from inferior border of mandible and posterior border of condyle and ramus to determine the same mentioned in [Figure 1] and [Figure 2].

**Table 1: Various parameter Measurements, Mean, of Cass I, Class II and Class III malocclusion**

Mal occlusion	No. Of patients	Mean age	SNA<sup>o</sup> mean	SNB<sup>o</sup> mean	ANB<sup>o</sup> mean	YEN<sup>o</sup> mean	W<sup>o</sup> mean	WITS (mm) mean	APP-BPP (mm) mean	Gonial Angle Mean		
										OPG-Right	OPG-left	Lateral cephaalogram
CLASS I	30	17.1	80.60	76.9	3.56	120.33	53.50	1.07	5.80	122.80	123.10	123.53
CLASS II	30	15.3	82.30	75.53	6.76	113.33	50.13	4.85	9.56	127.07	127.77	127.87
CLASS III	30	116.9	78.17	80.33	-2.13	130.57	61.27	-4.70	-1.16	129.43	130.30	129.47

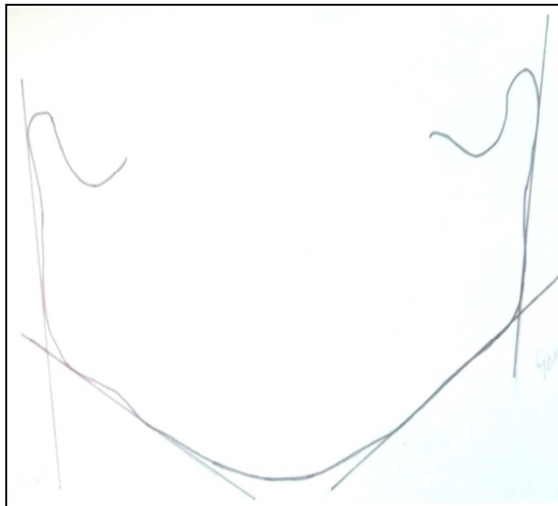


Figure 1

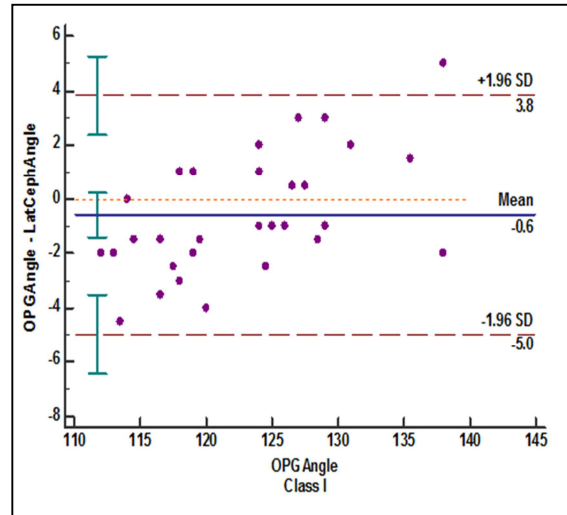


Figure 3a

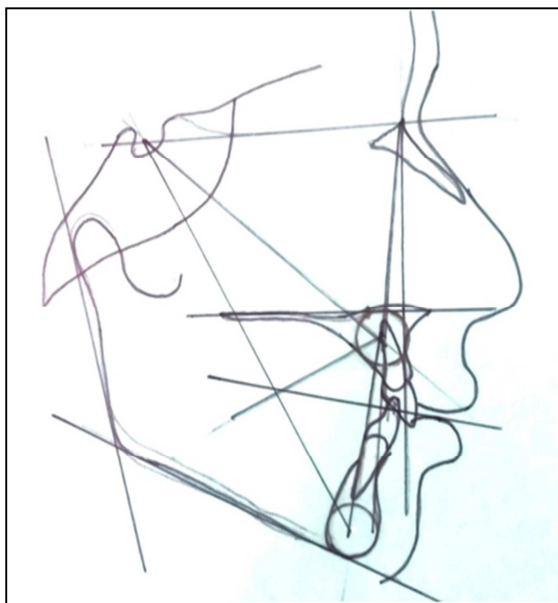


Figure 2

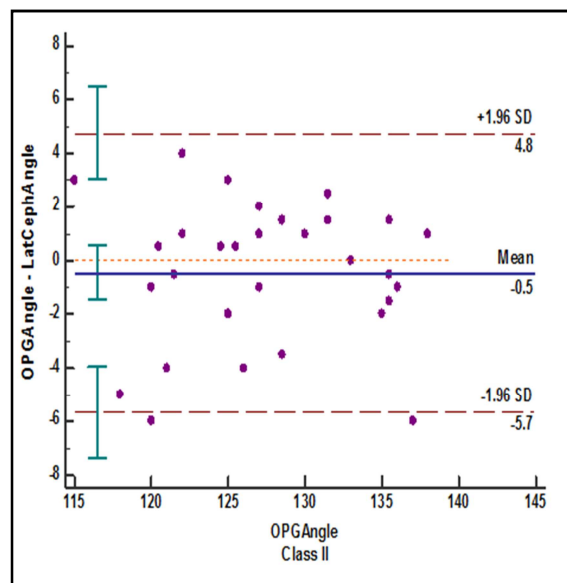
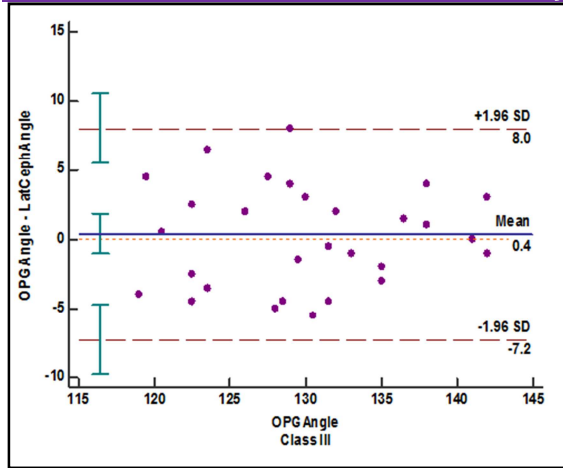


Figure 3b

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**Figure 3c**

**Statistical analysis**

Continuous variables were summarised as mean and standard deviation. The mean difference between the gonial angle as measured in orthopantomogram and on lateral cephalogram was calculated according to the class of malocclusion. Paired t-test was used to test the null hypothesis that the mean difference was zero. Intraclass correlation coefficient (ICC) along with its 95% confidence interval was reported. Bland-Altman plots were constructed to throw further light on the difference between gonial angle measured using the two methods. Two-sided p-values were reported and a p-

value less than 0.05 was considered statistically significant

**RESULTS**

The mean age of patients, malocclusion parameters and the mean gonial angle on orthopantomogram and lateral cephalogram are presented in [Table 1]. There was a strong correlation between gonial angle on orthopantomogram and lateral cephalogram among class I (ICC = 0.9434, 95% CI = 0.8850 to 0.9726), class II (ICC = 0.9196, 95% CI = 0.8394 to 0.9607) and class III (ICC = 0.8505, 95% CI = 0.7103 to 0.9258) malocclusions [Table 2].

**Table 2: Correlation between average gonial angle in OPG versus LATERAL CEPH among class I, Class II and Class III**

	Intraclass correlation a	95% Confidence Interval
Class I	0.9434	0.8850 to 0.9726
Class II	0.9196	0.8394 to 0.9607
Class III	0.8505	0.7103 to 0.9258

**Table 3: Average difference of gonial angle in OPG (orthopantomogram) and lateral cephalogram**

	Class I	Class II	Class III
Sample size	30	30	30
Arithmetic mean	-0.5833	-0.45	0.4
95% CI	-1.4199 to 0.2532	-1.4420 to 0.5420	-1.0573 to 1.8573
P (H0: Mean=0)	0.1645	0.3612	0.5789

**Table 4: Average differences in cephalometric gonial angle, gonial angle OPG right, gonial angle OPG left and gonial angle OPG in total.**

Class	Paired Differences	Mean	Std. Deviation	95% Confidence Interval of the Difference		p-value
				Lower	Upper	
				Class I	LeftOPG minus RightOPG	
	LatCephAngle - LeftOPG	.433	3.025	-0.696	1.563	.439
	LatCephAngle - RightOPG	.733	2.318	-0.132	1.599	.094
Class II	LeftOPG - RightOPG	.700	3.771	-0.708	2.108	.318
	LatCephAngle - LeftOPG	.100	3.241	-1.110	1.310	.867
	LatCephAngle - RightOPG	.800	3.274	-0.422	2.022	.191
Class III	LeftOPG - RightOPG	.867	3.481	-0.433	2.167	.183
	LatCephAngle - LeftOPG	-.833	4.178	-2.393	.727	.284
	LatCephAngle - RightOPG	.033	4.367	-1.597	1.664	.967

**Table 5: Intraclass Correlation Coefficient Left OPG and Right OPG, Left OPG and lateral cephalogram, Right OPG and lateral ceph**

	Class	Intraclass Correlation	95% Confidence Interval		p-value
			Lower Bound	Upper Bound	
Left OPG versus Right OPG	1	0.958	.912	.980	<0.001
	2	0.912	.816	.958	<0.001
	3	0.928	.850	.966	<0.001
Left OPG versus Lateral Ceph	1	0.951	.897	.977	<0.001
	2	0.94	.874	.971	<0.001
	3	0.904	.800	.954	<0.001
Right OPG versus Lateral Ceph	1	0.968	.931	.985	<0.001
	2	0.937	.868	.970	<0.001
	3	0.904	.797	.954	<0.001

The average difference in the gonial angle on orthopantomogram and lateral cephalogram was

0.58 degrees (95% CI = -1.4199 to 0.2532, p = 0.1645) in class I malocclusion, 0.45 degrees

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(95%CI =-1.4420 to 0.5420,p=0.3612) in class II malocclusion and 0.4 degrees (95%CI=-1.0573 to 1.8573, p=0.5789) in class III malocclusion. [Figures 3a, 3b and 3c] depicts the difference between gonial angle using the two methods against the gonial angle measured on orthopantomogram (the bland altman plot). The vertical lines in the figures represent the 95% confidence interval. The 95% confidence interval mean traverses the null value of zero in each of the three figures. almost all of the differences lie within the limits of 1.96 times the standard deviation of the differences. [Table 4] Shows the difference in gonial angle on the right and left side for each class of malocclusion. All p- values in [Table 4] are > 0.05, hence there was no statistically significant difference between the right and left gonial angles as measured on orthopantomogram. These results are further corroborated by the intraclass correlation coefficient shown in [Table 5].

### DISCUSSION

In fact there are various studies regarding the determination of gonial angle by lateral cephalogram and orthopantomogram.<sup>[5-7]</sup> Very few studies have compared the gonial angle on orthopantomogram and lateral cephalogram for various classes of malocclusion. Several studies have suggested that the panoramic gonial angle is as accurate as lateral cephalogram gonial angle,<sup>[4-7]</sup> OPG (orthopantomogram) has many other advantages over lateral cephalogram e.g, its ability to evaluate Mandibular asymmetry and Mandibular growth direction.<sup>[8-11]</sup> Studies have shown that the gonial angle may change with age because of masticatory muscular changes and decreased muscle activity and density.<sup>[12-13]</sup> According to Mattila et al and Dahan et al,<sup>[14,15]</sup> the size of the gonial angle may be inaccurate if different land marks are used for measuring gonial angle i.e Mandibular plane on orthopantomogram and lateral cephalogram 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, in contrast on a panoramic radiograph, the determination of the gnathion can be difficult, therefore, we used the tangent to the lower border of the mandible to measure the gonial angle in this study.

In this study we assessed the reliability of gonial angle in orthopantomogram compared to gonial angle in lateral cephalogram in various classes of mal occlusion i.e; Class I ,Class II and Class III subjects. The segregation of subjects with various types of mal occlusion was done to remove the confusion of disparity between the gonial angles of orthopantomogram and lateral cephalogram.

Therefore the study was carried out to rule out the type of mal occlusion and age could be the reason of disparity in gonial angle in orthopantomogram and lateral cephalogram. In this study 90 subjects were selected with age range of 12-30 years and divided into three groups (Grp 1-30 subjects class I), (Grp 2 -30 subjects class II), Grp 3-30 subjects class III). For varrifying classification of the malocclusion various measurements were done on orthopantomogram and lateral cephalogram which are shown in [Table 1]. Brandie's etal in their study have concluded that the disparity between gonial angle of orthopantomogram and lateral cephalogram could be because of the type of mal occlusion and age of the patient.<sup>[16]</sup> However, they found gonial angle on panoramic radiograph 2.2–3.6 degrees less than lateral cephalograms which made us to think the reliability of gonial angle on orthopantomogram. In another study of Shahabi et al.<sup>[5]</sup> which concluded that the difference between the two gonial angles of ortopantomogram and lateral cephalogram were not significant. Hence orthopantomogram could be the good indicator for determining the gonial angle. However the drawback of this study was only subjects with class I malocclusion which made us to think the reliability of gonial angles in Class II and Class III malocclusion.

Therefore keeping in view the context of the study we have done analysis separately in our study for each class of mal occlusion and in a specific age group to find out the reliability of gonial angle in class I, class II and class III cases. The result of the study determined the high degree of reliability in gonial angles of orthopantomogram on comparing with lateral cephalogram gonial angle which is interpreted in coelation coefficient depicting high resembling values in class I, class II and class III subjects shown in [Table 3]. Bland altman plot also exhibits no significant differences in gonial angles between OPG and LAT CEPH among class I, class II, and class III cases which is analogous to the previous studies.<sup>[5,6]</sup> In this study correlation coefficient was significant in (left gonial angle OPG and right gonial angle OPG), which is analogous to the result of adila et al,<sup>[17]</sup> in his study (left gonial OPG and lateral cephalogram) and (right gonial angle OPG and lateral cephalogram) showing high resemblance of gonial angle among class I, Class II and class III respectively shown in [Table 4]. Whileas, average differences in cephalometric gonial angle, gonial angle OPG right, gonial angle OPG left and gonial angle OPG in total was found statistically non significant depicting the high resemblance of gonial angles in cephalogram and orthopantpmogram among class I, class II and class III respectively which is analogous to previous study.<sup>[5,9,15,16]</sup>

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### CONCLUSION

The study concluded that in all forms of classification i.e., class I, class II, and class III subjects, panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram as there are no significant differences in the gonial angle values as measured on cephalogram and OPG. In addition, OPG forms an additional tool for easier and more accurate determination of both right and left gonial angles of a patient without interferences due to superimposed images of anatomical structures in a lateral cephalogram. For determination of the gonial angle, an OPG may be a choice than a lateral cephalogram as the overlapping of condyle may interfere for the determination of gonial angle on lateral cephalogram. Thus, the present study substantiates the possibility of enhancing the clinical versatility of the panoramic radiograph, which is an indispensable tool for dental diagnosis

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