

# TO INVESTIGATE THE RELIABILITY OF PANORAMIC RADIOGRAPH COMPARED TO THAT OF A LATERAL CEPHALOGRAM FOR ASSESSING DENTOSKELETAL PATTERN

*-In vitro study*

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## ABSTRACT

This study was conducted to investigate whether panoramic radiographs can be used instead of lateral cephalograms for assessing dento-skeletal pattern. The study conducted in – vitro on 60 diagnostic lateral cephalograms and panoramic radiographs. The result of this study showed that with standard exposure conditions and high image quality, panoramic radiograph can provide information to assess the dento-skeletal pattern of the patient, however for vertical dimension especially in the maxillary/mandibular anterior region, they are not reliable enough to give acceptably accrete additional information as compared to lateral cephalograms.

**Keywords:** Lateral Cephalograms, Panoramic Radiographs, Dento-Skeletal Pattern

## INTRODUCTION

In 1931, Broadbent in the USA and Hofrath in Germany introduced the technique of radiographic cephalometry. Since then, clinicians and researchers have adopted and routinely used this valuable tool to analyze the underlying dentofacial relationships. Although the lateral cephalogram provides us a lot of information regarding the craniofacial structures, it is impossible to accurately visualize the right and left sides of these structures in a single radiograph due to the superimposition of the two sides.

The panoramic radiograph developed by **Paatero. Y.V.** in 1948 however allow the visualization of left and right sides of craniofacial structures by producing an accurate, predictable image of all the teeth and related structures on a radiograph, in the shortest possible time, with the least amount of radiation to the patient and to the operator and with the minimal amount of superimposition of various structures. Facial and mandibular asymmetries are of special interest to the orthodontist. There are some published data about the effect of orthodontic treatment on the temperomandibular joint screened on the panoramic radiographs.

Aiming to enhance the clinical versatility of the panoramic radiograph, the objective of the present study is to investigate whether we can use panoramic radiograph instead of lateral cephalogram to assess dento skeletal pattern. In the present study, measurements will be taken from 60 panoramic radiographs and will be compared with the measurements taken from lateral cephalograms to determine whether the usage of panoramic radiograph could be extended for evaluating dento-skeletal pattern.

### Aim:

1. To investigate the reliability of panoramic radiograph compared to that of a lateral cephalogram for assessing dentoskeletal pattern.

### Objectives:

1. To investigate whether panoramic radiographs can be used as an alternative to lateral Cephalogram to predict dentoskeletal pattern by measuring angular measurements.
2. To evaluate the variations of Angular measurements on both sides of the panoramic radiographs.
3. To check for the reproducibility of the original

study on Indian population and evaluate whether the measurements are influenced by the sex of an individual.

**MATERIALS AND METHODS**

This study was conducted on 60 patients who came to the Department of Orthodontia, M.R. Ambedkar Dental College for regular orthodontic treatment. A total 30 male and 30 female patients were selected for the study. This study was divided

into two parts. In the first part of the study conventional angular and linear measurements of the lateral cephalogram were compared with the corresponding angular and linear measurements on the Panoramic radiograph.

In the second part of the study a comparison was done to check for any difference between the angular and linear measurements taken on the left and right side of the Panoramic radiograph.

<b>Linear measurements used for the assessment of-</b>	<b>Landmarks used in cephalogram</b>	<b>Landmarks used in panoramic radiograph</b>
Ramal length	Condylion- gonion	Condylion- gonion
Mandibular body length	Gonion-menton	Gonion-menton
Maxillary basal bone length	Anterior nasal spine-posterior nasal spine	Anterior nasal spine-posterior nasal spine
Maxillary dentoalveolar bone height (anterior)	Incisive superiors perpendicular to nasal float	Incisive superiors perpendicular to nasal float
Maxillary dentoalveolar bone height (posterior)	Mesiobuccal cusp tip of maxillary first permanent molar perpendicular to nasal floor	Mesiobuccal cusp tip of maxillary first permanent molar perpendicular to nasal floor
Mandibular dentoalveolar bone (anterior)	Incisive inferiors perpendicular to mandibular plane	Incisive inferiors perpendicular to mandibular plane
Mandibular dentoalveolar bone height (posterior)	Mesiobuccal cusp tip of mandibular first permanent molar perpendicular to mandibular plane	Mesiobuccal cusp tip of mandibular first permanent molar perpendicular to mandibular plane

**Table-I:** the linear measurements measured on the lateral cephalogram and compared on the panoramic radiograph

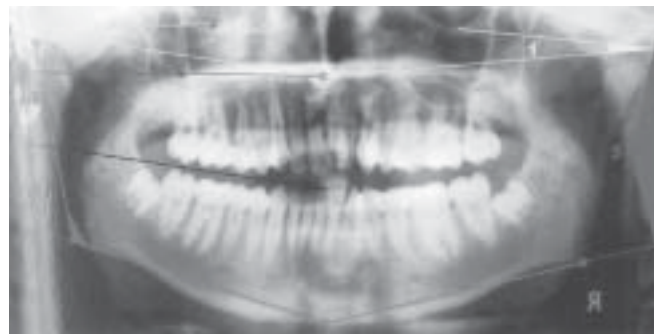
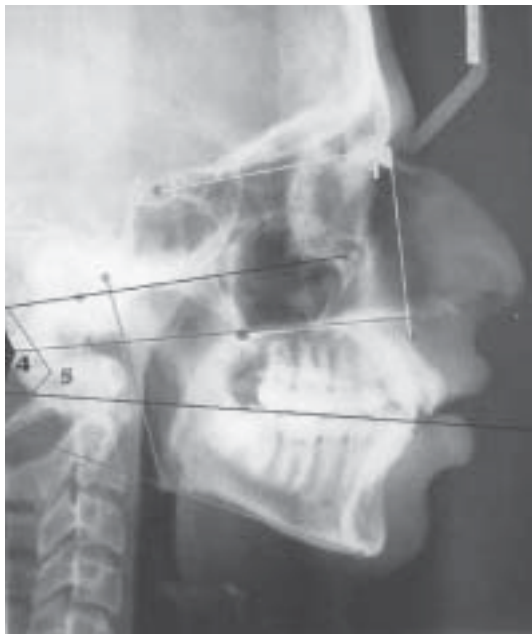
<b>Angles used for assessment of-</b>	<b>Landmarks used in cephalogram</b>	<b>Landmarks used in panoramic radiograph</b>
Skeletal antero posterior dysplasia of the maxilla	Sella-nasion point A	Opbitale-porion-ans
Morphology of the mandible	Condylion ginion menton	Condylion gonion menton
Inclination of mandibular plane	Interescrion of ans-pns plane and gonion-menton plane	Intersection of ans-pns plane and gonion menton plane
Cant of occlusal plane	Intersection of occlusal plane and porion orbitale plane	Intersection of occlusal plane and porion orbitale plane
Growth pattern	Intersection of porionorbirale plane and gonion-menton plane	Intersection of porionorbirale plane and gonion-menton plane

**Table –II:** the angular measurements measured on the lateral cephalogram and compared on the panoramic radiograph.

**THE LINEAR MEASUREMENTS MEASURED ON THE LATERAL CEPHALOGRAM AND COMPARED ON THE PANORAMIC RADIOGRAPH**



**THE ANGULAR MEASUREMENTS MEASURED ON THE LATERAL CEPHALOGRAM AND COMPARED ON THE PANORAMIC RADIOGRAPH**



**RESULTS:****Ramal Length  
(CONDYLION-GONION)**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalo-metric	53.5	5.18	5.18	<0.001
Panoramic Right	58.58	8.11	5.84	<0.001
Panoramic Left	59.52	8.26	5.84	<0.001

**Table- III (a)** shows the cephalometric mean value for ramal length (condylion-gonion).

**Mandibular body length  
(GONION-MENTON)**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalo metric	68.25	6.92	18.98	< 0.001
Panoram ic-Right	97.9	14.19	19.26	< 0.001
Panoram ic-Left	97.8	14.09	19.26	< 0.001

**Table III (b)** ( shows the cephalometric mean values of mandibular body length (gonion-mention).

**Maxillary Basal Bone Length**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalo metric	52.58	5.86	8.42	<0.001
Panoram ic-Right	65.93	15.17	8.35	<0.001
Panoram ic-Left	65.85	15.38	8.35	<0.001

**Table III (c):** Shows the shows the cephalometric mean values of maxillary basel bone length (anterior nasal spine-posterior nasal spine).

**Maxillary Dentoalveolar Bone Height (Anterior)**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalometric	28.03	3.59	7.28	<0.001
Panoramic Right	34.22	6.31	7.28	<0.001
Panoramic-Left	34.22	6.31	7.28	<0.001

**Table III(d):** Shows the cephalometric mean values of maxillary dentoalveolar bone height (anterior) (incisive superioris perpendicular to nasal floor) body length.

**Maxillary Dentoalveolar Bone Height (Posterior)**

Variable	Mean	SD	Paired "t" test	"P" Value
Caphalo metric	22.63	2.94	10.69	<0.001
Panoramic-Right	28.77	5.34	11.72	<0.001
Panoramic-Left	29.45	5.25	11.72	<0.001

**Table III (e):** Shows the cephalometric mean values of maxillary dentoalveolar bone height (posterior) (mesiobuccal cusp tip of maxillary first permanent molar perpendicular to nasal floor).

**Mandibular Dentoalveolar Bone Height (Anterior)**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalometric	42.93	5	3.77	<0.001
Panoramic-Right	39.48	6.09	3.69	<0.001
Panoramic Left	39.55	6.06	3.69	<0.001

**Table III (f):** Shows the cephalometric mean values of mandibular dentoalveolar bone height (anterior)(incisive inferioris perpendicular to mandibular plane) of 42.93 mm  $\pm$  5 and panoramic mean value of 39.48 mm  $\pm$  6.09 and 39.55 mm  $\pm$  6.06 for right and left side respectively.

**Mandibular Dentoalveolar Bone Height (Posterior)**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalometric	32.67	3.72	8.24	<0.001
Panoramic Right	38.53	5.86	8.95	<0.001
Panoramic Left	38.95	5.74	8.95	<0.001

**Table III (g):** Shows the cephalometric mean values of mandibular dentoalveolar bone height (Posterior)(mesiobuccal cusp tip of mandibular first permanent molar perpendicular to mandibular plane).

**Skeletal Antero Posterior Dysplasia of the Maxilla**

Variable	Mean	SD	Paired "t" test	"P" Value
Ceph (SNA)	83.2	5.96	59.37	<0.001
Pano(R)(Or-po-ANS)	10.88	14.09	59.32	<0.001
Pano(L)(Or-po-ANS)	11.4	14.96	59.32	<0.001

**Table IV(a):** Shows the cephalometric mean value for skeletal anterior posterior dysplasia of maxilla (SNA).

**Morphology of the mandible  
(condylion-gonion-menton)**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalo metric	123.18	6.42	10.53	<0.001
Panoramic Right	117.6	5.23	10.38	<0.001
Panoramic Left	117.2	5.17	10.38	<0.001

**Table IV(b):** Shows the cephalometric mean value for morphology of the mandible (condylion-gonion- menton).

**Inclination of Mandibular Plane**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalo metric	25.83	6.86	8.78	<0.001
Panoramic Right	19.42	4.92	9.19	<0.001
Panoramic Left	19.32	4.82	9,19	<0.001

**Table IV (c) :** Shows the cephalometric mean value for inclination of mandibular plane (intersection of ANS-PNS plane and gonion-menton plane).

**Cant of Occlusal Plane**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalo metric	11.35	4.19	3.17	<0.001
Panoramic Right	13.47	4.47	3.96	<0.001
Panoramic Left	13.78	4.72	3.96	<0.001

**Table IV (d) :** Shows the cephalometric mean value for cant of occlusal plane (intersection of occlusal plane and porion-orbitale plane).

**Growth pattern**

Variable	Mean	SD	Paired "t" test	"P" Value
Cephalo metric	25.98	5.64	10.24	<0.001
Panoramic Right	19.17	5.02	11.58	<0.001
Panoramic Left	19.12	4.65	11.58	<0.001

**Table IV (e):** Shows the cephalometric mean value for growth pattern (intersection of porion orbitale plane and gonion-menton plane).

**TABLE V**  
**CORRELATION BETWEEN CEPHALOMETRIC AND**  
**PANORAMIC LINEAR MEASUREMENTS**  
The values indicates Pearson's Correlation coefficient = r

	PANO 1	PANO 2	PANO 3	PANO 4	PANO 5	PANO 6	PANO 7
Ceph 1	0.394	0.484	0.41	0.312	0.483	0.32	0.47
"P" value	< 0.003	<0.001	<0.002	<0.002	<0.001	<0.02	<0.001
Ceph2	0.32	0.54	0.41	0.29	0.43	0.33	0.38
"P" value	<0.02	<0.001	<0.001	<0.003	<0.001	<0.02	<0.01
Ceph 3	0.36	0.39	0.65	0.38	0.39	0.35	0.38
"P" Value	<0.01	<0.01	<0.001	<0.02	<0.01	<0.01	<0.01
Ceph 4	0.09	0.07	0.03	0.2	0.14	0.026	0.28
"P" value	NS	NS	NS	NS	NS	NS	<0.05
Ceph 5	0.74	0.4	0.26	0.44	0.54	0.31	0.48
"P" value	<0.001	<0.001	<0.01	<0.001	<.001	<0.02	<0.001
Ceph 6	0.003	0.15	0.08	0.16	0.17	0.19	0.31
"P" value	NS	NS	NS	NS	NS	NS	0 < 0.02
Ceph 7	0.08	0.27	0.14	0.15	0.21	0.17	0.41
"P" value	NS	<0.05	NS	NS	NS	NS	<0.01

**TABLE VI**  
**CORRELATION BETWEEN CEPHALOMETRIC AND**  
**PANORAMIC ANGULAR MEASUREMENTS**

The value indicates Pearson's Correlation coefficient = r

	PANO 8	PANO 9	PANO 10	PANO 11	PANO 12
Ceph 8	0.86	0.029	0.143	0.21	0.276
"P" value	<0.001	NS	NS	NS	<0.05
Ceph 9	0.28	0.754	0.591	0.278	0.46
"P" value	NS	<0.001	<0.001	<0.01	<0.001
Ceph 10	0.031	0.602	0.608	0.35	0.63
"P" value	NS	<0.001	<0.001	<0.01	<0.001
Ceph 11	0.043	0.156	0.299	0.373	0.37
"P" value	NS	NS	<0.1	<0.01	<0.01
Ceph 12	0.043	0.42	0.698	0.388	0.594
"P" value	NS	<0.01	<0.001	<0.01	<0.001

NS= Non Significant

**Table shows the Mean values and Standard Deviation for panoramic left and right angular parameters.**

Angles Used for Assessment of:	Mean values and Standard deviation for panoramic left side	Mean value Standard deviation for panoramic right side
<b>Skeletal Antero posterior dysplasia of the maxilla</b>	11.4 ± 14.96	10.88 ± 14.09
<b>Morphology of the mandible (Condylion-Gonion-Menton)</b>	117.2 ± 5.17	117.6 ± 5.23
<b>Inclination of Mandibular plane (Intersection of Ans-Pns plane and Gonion0Menton Plane)</b>	19.32 ± 4.82	19.42 ± 4.92
<b>Cant of occlusal plane (Intersection of occlusal plane and porion-orbitale plane)</b>	13.78 ± 4.72	13.47 ± 4.47
<b>Intersection of porion-orbitale plane and Gonion-Me4nton plane</b>	19.12 ± 4.65	19.17 ± 5.02

**Table shows the regression equations for linear parameters in which multiple regression equation test was applied with best possible panoramic constant to get highest predictability value.**

Predicted Cephalometric parameters	Panoramic Constant	Equation (Predicted parameter = constant( $\pm$ SD) + coefficient ( $\pm$ SD) OPG parameter	R <sup>2</sup>	P
(Cephalometric 1)	(Panoramic 2)	Cephalometric 1=36.07 ( $\pm$ 4.18) +0.18 ( $\pm$ 0.04) Panoramic 2	0.23	Constant 0.001 Predictor 0.001 Regression 0.001
(Cephalometric 2)	(Panoramic 2)	Cephalometric 2=42.53 ( $\pm$ 5.39) +0.26 ( $\pm$ 0.06) Panoramic 2	0.27	Constant 0.001 Predictor 0.001 Regression 0.001
(Cephalometric 3)	(Panoramic 3)	Cephalometric 3 = 36.02 ( $\pm$ 2.59) + 0.25 ( $\pm$ 0.04) Panoramic 3	0.43	Constant 0.001 Predictor 0.001 Regression 0.001
(Cephalometric 4)	(Panoramic 7)	Cephalometric 4=21.21( $\pm$ 3.12) +0.08)Panoramic 7	0.08	Constant 0.001 Predictor 0.03 Regression 0.03
	(Panoramic 7)	Cephalometric 4=26.62 ( $\pm$ 2.95) +0.58 ( $\pm$ 0.11) Panoramic 7	0.32	Constant 0.001 Predictor 0.001 Pan 7 & 1 =0.001 Regression 0.001
	(Panoramic 1)	0.36 ( $\pm$ 0.08) Panoramic 1		
(Cephalometric 5)	(Panoramic 5)	Cephalometric 5=13.88( $\pm$ 1.83) +0.30 ( $\pm$ 0.06) Panoramic 5	0.29	Constant 0.001 Predictor 0.001 Regression 0.001
	(Panoramic 5)	Cephalometric 5=17.05 ( $\pm$ 2.31) +0.44 ( $\pm$ 0.09) Panoramic 5	0.34	Constant 0.001 Predictor Pano 5=0.001 Pano 1 = 0.037 Regression 0.001
	(Panoramic 1)	-0.12 ( $\pm$ 0.06) Panoramic 1		
(Cephalometric 6)	(Panoramic 7)	Cephalometric 6 =32.39( $\pm$ 4.31) +0.27 ( $\pm$ 0.11) Panoramic 7	0.10	Constant 0.001 Predictor 0.02 Regression 0.02
	(Panoramic 7)	Cephalometric 6=38.35 ( $\pm$ 4.33) + 0.72 ( $\pm$ 0.16) Panoramic 7	0.25	Constant 0.001 Predictor Pano 7=0.001 Pano 1 = 0.001 Regression 0.001
	(Panoramic 1)	0.39 ( $\pm$ 0.11) Panoramic 1		
(Cephalometric 7)	(Panoramic 7)	Cephalometric 7=22.15 ( $\pm$ 3.07) + 0.27 ( $\pm$ 0.08) Panoramic 7	0.17	Constant 0.001 Predictor 0.001 Regression 0.001
	(Panoramic 7)	Cephalometric 7=26.80 ( $\pm$ 3.02) + 0.62 ( $\pm$ 12) Panoramic 7	0.34	Constant 0.001 Predictor Pano 7=0.001 Pano 1=0.001 Regression 0.001
	(Panoramic 1)	0.31 ( $\pm$ 0.08) Panoramic 1		



**Shows the regression equations for angular parameters in which multiple regression equation test was applied with best possible panoramic constant to get highest predictability value.**

Predicted Cephalometric parameters	Panoramic Constant	Equation (Predicted parameter = constant( $\pm$ SD) + coefficient ( $\pm$ SD) OPG parameter	R <sup>2</sup>	P
Sella-nasion-point a (ceph 8)	Orbitaleporion-ans (pano8)	Ceph 8=79.13 ( $\pm$ 0.51)+0.37 ( $\pm$ 0.03) pano 8	0.74	Constant 0.001 Predictor 0.001 Regression 0.001
	Pano 8	Ceph 8=85.27 ( $\pm$ 1.51)+0.36 ( $\pm$ 0.03) pano 8	0.80	Constant 0.001 Predictor Pano 8=0.001
	Pano 12	-0.32 ( $\pm$ 0.08) Pano 12		Pano 12=0.001 Regression 0.001
Condylion-gonion-mentor (ceph 9)	Condylion-gonion-menton (Pano 9)	Ceph 9=12.88 ( $\pm$ 12.63)+0.94 ( $\pm$ 0.11) Pano 9	0.57	Constant 0.31 (ns) Predictor 0.001 Regression 0.001
	(Pano 10)	Ceph 9=18.17 ( $\pm$ 10.05)+0.80 ( $\pm$ 0.09) pano 9 +0.57 ( $\pm$ 0.09) pano 10	0.73	Constant 0.08 (ns) Predictor 0.03 Regression 0.03
Intersection of ans-pns plane and gonion-menton plane (ceph 10)	(Pano 12)	Ceph 10=8.23 ( $\pm$ 2.96) +	0.39	Constant 0.001 Predictor
	(Pano 12)	0.92 ( $\pm$ 0.15) pano 12	0.52	Pano 9=0.001
	(Pano 9)	Ceph10=49.39 ( $\pm$ 15.0)+0.65 ( $\pm$ 0.15) pano 12 + 0.53 ( $\pm$ 0.14) pano 9		Pano 10=0.001 Regression 0.001
	(Pano 12)	Ceph 10=	0.63	Constant 0.001 Predictor
	(Pano 9)	-51.72( $\pm$ 13.35)+0.40 ( $\pm$ 0.15)		Pano 12=0.01
	(Pano 10)	Pano 12 +0.51( $\pm$ 0.12)pano 9 + 0.54 ( $\pm$ 0.14) pano 10		Pano 9=0.001 Pano 10=0.001 Regression 0.001
Intersection of occlusal plane and porion-orbitale plane (ceph 11)	(Pano 11)	Ceph 11=6.58 ( $\pm$ 10.64)+0.35 ( $\pm$ 1.12) pano 11	0.14	Constant 0.001 Predictor 0.03 Regression 0.03
Intersection of porion-orbital plane and gonion-menton plane (ceph 12)	(Pano 10)	Ceph 12=9.99( $\pm$ 2.22)+0.83 ( $\pm$ 0.12) pano 11	0.49	Constant 0.001 Predictor 0.001 Regression 0.001
	(Pano 10)	Ceph12 = 6.01 ( $\pm$ 2.36)		Constant 0.014 Predictor
	(Pano 12)	+0.63 ( $\pm$ 0.12) pano 10 0.40( $\pm$ 0.12) pano 12	0.57	Pano 10=0.001 Pano 12=0.001 Regression 0.001

### DISCUSSION:

Lateral cephalometry is an important tool in orthodontic diagnosis, treatment planning, and evaluation of treatment results and prediction of growth. But the major source of error in cephalometric analysis includes radiographic film magnification, tracing, measuring, recording and landmark identification. To overcome all these limitations of lateral cephalograms, Paatero in 1961 introduced a technique called panoramic radiography which has gained a rapidly significant role in almost every field of clinical dentistry. The popularity of this technique stemmed from its simplicity of operation, its low radiation dosage when compared to conventional lateral cephalogram and full mouth radiographs, and the wide field of projected structures with reduced super imposition of investing tissue. Some limitations of lateral cephalograms may be overcome by using panoramic radiograph. Therefore it is logical to evaluate the accuracy of measurements gleamed for panoramic radiograph as compared to lateral cephalogram for investigating dentoskeletal patterns.

It is possible to measure any vertical or horizontal distance is only on one side of the mandible, either the left or the right, but that the distance must not transverse the midline of the mandible.

Linear measurements are not reliable because of the magnification factor in the radiographs to eliminate the magnification factor the ratios of the linear measurements were taken and compared between lateral cephalogram and panoramic radiograph and all the radiographs were taken using same machine (PLANMECA PM-2002 EC PROLINE) and by the same operator under standard exposure conditions.

In the present study only one horizontal parameter was compared between lateral cephalogram and panoramic radiograph i.e., the maxillary basal bone length. It was found that significant amount of co-relation exist when the maxillary basal bone length was measured from lateral cephalogram and panoramic radiograph as the multiple regression equation shows 45% predictability of maxillary basal bone length from panoramic radiographs.

The weakness in radiological interpretation of linear measurements in the anterior region of the jaw contributed to investigate the reliability of vertical dimensions from panoramic radiograph.

In the present study also the measurement for anterior maxillary dent alveolar heights compare between panoramic radiograph and lateral cephalogram are not reliable as evidence from the correlation coefficient value which comes out to be 0.2 (highly non significant). For posterior maxillary dent alveolar height the co-relation coefficient between panoramic value and cephalometric value is 0.54, showing that posterior maxillary dent alveolar height can be measured from panoramic radiograph. This result again favours the study done by Xie. Q et al that vertical measurement are more reliable in the maxillary posterior region as compared to the anterior region.

A mandibular anterior region measurement for panoramic radiograph and cephalogram shows the co-relation coefficient of 0.19. This study shows that predicting the cephalometric mandibular anterior dent alveolar height value from panoramic radiograph is not reliable for clinical purpose.

A fourth vertical measurements used in the present study to compare were mandibular dentoalveolar height posterior. The co-relation coefficient value when compared between panoramic radiograph and cephalogram was 0.41 which is highly significant. Thus by using the panoramic mandibular dento alveolar posterior height value and panoramic ramal length value, cephalometric dentoalveolar height posterior can be predictable to significant level.

In the present study, two linear oblique variables were compare i.e., ramal length (Co-Go) and mandibular body length (Go-Me) and both variable lies on one side of the mandible. The result of the present study showed that the correlation coefficient between panoramic ramal length and cephalometric ramal length was 0.394 which is clinical significant.

For mandibular body length (Go-Me), the correlation coefficient between panoramic value and cephalometric value in the present study is 0.54 which is highly significant.

Various studies have been done in the past to investigate the reliability of angular measurements taken from panoramic radiograph. The values for the gonial angle are of particular interest because lateral cephalograms do not permit reliable registration of this angle and the super imposition images create difficulties in recognition and measurement of the individual angle. This disadvantage is not encountered in panoramic radiography, which has proved to be as accurate as cephalography in determining the gonial angle. The co-relation between cephalometric and panoramic radiograph measurements found that gonial angles of panoramic radiograph and basal plane angles of cephalogram showed high correlation of 0.49.

Thus the present study is in favour with all the previous studies that gonial angle can be predicted reliably from the panoramic radiograph. The predictability of cephalometric mandibular plane angles from panoramic radiograph have been studied and concluded that instead of panoramic mandibular plane angles giving highest predictability value for mandibular plane angles, it was panoramic basal plane angle whose correlation coefficient with cephalometric mandibular plane angle was remarkably high i.e., upto 0.76. The present study also favours the study done by Ackam et al. Hence it is recommended that, to predict the cephalometric mandibular plane angle, both panoramic mandibular plane and panoramic basal plane angle should be used.

The present study used panoramic angle (orbitaleporion-ANS) to predict cephalometric SNA angle and found that correlation coefficient was 0.86, slightly less than what Ackam deduced in his study. The regression equation also shows that cephalometric SNA angle can be predicted from panoramic (orbitale-porion-ANS) angle by 74% predictability. Basal plane angle between lateral cephalometric and panoramic radiographs was also compared in this study and the correlation coefficient was 0.608 suggesting that cephalometric basal plane angles can be predicted to significant level from panoramic radiograph. But the regression equation shows that the predictability level using panoramic gonial angle, basal plane angle and mandibular plane angle to

predict cephalometric basal plane angle increases upto 63%.

It was found that the correlation coefficient between cephalometric cant of occlusal plane and panoramic cant of occlusal plane was just 0.373, suggesting that predicting cephalometric cant of occlusal plane from panoramic radiograph is not reliable. The regression equation also shows that the predictability level was just 14%. Thus an orthodontist should be cautious while comparing cephalometric cant of occlusal plane from panoramic radiograph.

No significance difference was found between angular measurements for panoramic left and right side in the present study and all the angular and linear measurements were not influenced by the sex of an individual.

#### **SUMMARY AND CONCLUSION:**

The present study was undertaken in an attempt to answer whether panoramic radiograph can be used instead of lateral cephalogram to assess dento-skeletal pattern of the patient.

#### **THE RESULT OF THIS STUDY SHOWED THAT :**

1. All angular parameters measured on panoramic radiograph showed high correlation and predictability when compared with similar parameters measured on lateral cephalogram especially for gonial angle measurements except for cant of occlusal plane, which shows least predictability when measured from panoramic radiograph. Thus panoramic radiographs can be used for angular measurements instead of lateral cephalogram.
2. For vertical parameters measured on panoramic radiographs, in posterior region (molar area) the correlation and predictability was acceptable and clinically significant when compared with similar parameters in lateral cephalogram, but the measurements done in the maxillary and mandibular anterior region were not reliable when measured from a panoramic radiograph. Thus a clinician should be careful while measuring vertical measurements in maxillomandibular anterior region from panoramic radiographs.

3. Oblique and horizontal measurements done on panoramic radiograph also shows that these measurements can be recorded from panoramic radiograph with high predictability.
4. No significance difference was found between angular measurements for panoramic left and right side in the present study and all the angular and linear measurements were not influenced by the sex of an individual.

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