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ORTHOPANTOMOGRAM AND LATERAL CEPHALOGRAM: A COMPARATIVE STUDY FOR MANDIBULAR MEASUREMENTS IN THE MARATHA COMMUNITY.

Orthodontics

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ABSTRACT

Introduction: In orthodontics, diagnostic tools are critical to the diagnosis and development of treatment plans. Important information may be obtained from a range of instruments, including study models, clinical examinations, and radiographs such lateral cephalograms and panoramic radiographs. Among the most notable is the orthopantomogram (OPG), which has developed into an essential diagnostic tool for doing thorough examinations of the skeletal and oral structures. Using a lateral cephalogram, orthodontists can more closely examine dentofacial anomalies. **Aim And Objective:** Through a comparison with lateral cephalograms, the aim of this study is to examine the potential usefulness of orthopantomograms (OPG) in evaluating craniofacial traits, including angular and linear measurements of the mandible. **Materials & Methods:** This study will involve the inclusion of orthopantomograms (OPG) and lateral cephalograms obtained from the orthodontic records of 100 patients aged between 12 and 28 years at DY Patil Dental School, Pune. Lateral cephalograms and OPG will assess both angular measurements (gonial angle) and linear measurements (body length and ramus height). An independent t-test via SPSS will be used for statistical analysis, while $P < 0.05$ will be utilized as a level of significance for evaluating statistical significance. **Results:** The findings of our investigation show that there is a significantly significant difference between lateral cephalograms and panoramic radiographs (OPG) in terms of gonial angle and ramus height. For body length, however, there is also a statistically significant variance between lateral cephalograms and OPG. **Conclusion:** In conclusion, the study suggests that panoramic radiography may not be as precise as lateral cephalograms in determining the gonial angle, ramus height, and body of the mandible.

KEYWORDS

Body Length, Gonial Angle, Lateral Cephalogram Orthopantomogram, Ramus Height

INTRODUCTION

Diagnostic instruments are essential for making diagnoses and creating treatment programs in orthodontics. A variety of tools, such as radiographs like lateral cephalograms and panoramic radiographs, study models, and clinical tests, provide vital information. Particularly noteworthy is the orthopantomogram (OPG), which has evolved into a vital diagnostic aid for conducting comprehensive assessments of dental and skeletal frameworks. First introduced by Prof. Yrjö Paatero in 1961, and minimum radiation exposure for both patients and operators.

The lateral cephalogram, was developed by Broadbent in 1931, empowers orthodontists to scrutinize dentofacial abnormalities. The gonial angle is the angle created by the junction of two lines, one parallel to the mandible's base and the other to its ramus. In vertical growing patients, gonial angle is obtuse whereas the mandible shows clockwise rotation, and in horizontal growing patients, the gonial angle is acute signifies anti-clockwise rotation of the mandible.

Recent literature states that, OPG was found to the better diagnostic aid as compared to lateral cephalogram. Image super-imposition on lateral cephalogram make OPG an ideal diagnostic measurement for craniofacial anomalies.

The accuracy of OPG was highlighted by Larheim & Svanaes' observations of complexity in lateral cephalogram measurements, On the other hand, Mattila et al.'s investigation found contradictory data to support their conclusion that the gonial angle was measured concurrently on the lateral cephalogram and OPG[1,2]. Nevertheless, ongoing debates persist regarding the preferred diagnostic tool for different aspects of craniofacial structures.

The current investigation uses lateral cephalograms and OPG as diagnostic tools that better comprehend angular and linear mandibular measurements. Additionally, it endeavours to establish a correlation between these measurements and lateral cephalograms. The ongoing discussion highlights the nuanced roles of each diagnostic tool, recognizing the reliability of OPG for specific aspects while acknowledging the unique contributions of lateral cephalograms in capturing other crucial diagnostic information.

MATERIALS & METHOD

This study will involve the inclusion of orthopantomograms (OPG) and lateral cephalograms obtained from the orthodontic records of 100 patients aged between 12 and 28 years at DY Patil Dental School, Pune. Lateral cephalograms and OPG will assess both angular measurements (gonial angle) and linear measurements (body length and ramus height). An independent t-test via SPSS will be used for statistical analysis, while $P < 0.05$ will be utilized as a level of significance for evaluating statistical significance.

The radiographs were drawn by hand on matte acetate sheets measuring 0.003 inches. The osteometric landmarks Gonion (Go), Menton (Me), and Condylion (Co) were used in the current study.

A scale was used for linear measurements, and a protractor was used for angle measurements. Accurate readings were taken, with linear measures rounded to the nearest 0.5 mm and angular measurements to the nearest half a degree Measurements.

Metric Measurements (linear) (mm):

1**. Gonion-Menton (Go-Me) measurement:** This represents the body length of the mandible and is taken from the designated gonion point to menton. (Figures 1, 2).

2**. Condylion-Gonion (Co-Go):** This measurement, which shows the

mandible's ramus height, is made from the chosen Condylion point to Gonion. (Figures 1, 2).

Measurements Of Angle (in degrees):

1. **Gonial angle:** This angle is created at the point where the tangents to the mandible's ramus and lower border intersect. (Figures 1, 2)

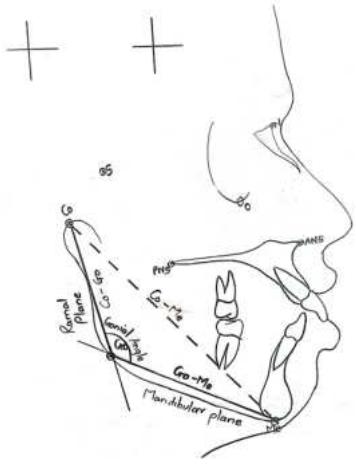


Figure 1: Gonial angle, ramus height, and body length are displayed in the lateral cephalogram tracing (Go-Me, Co-Go). Three markers were used: Co-Condylion, Me-Menton, and Go-Gonion.

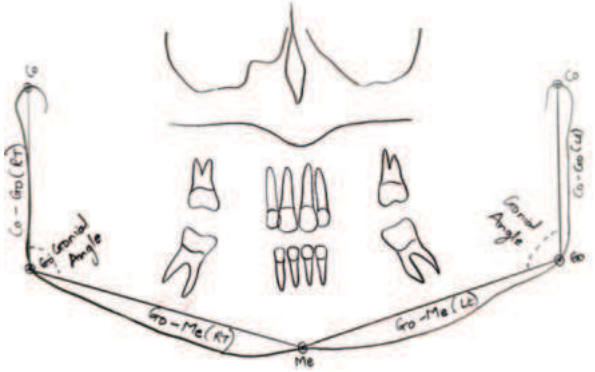
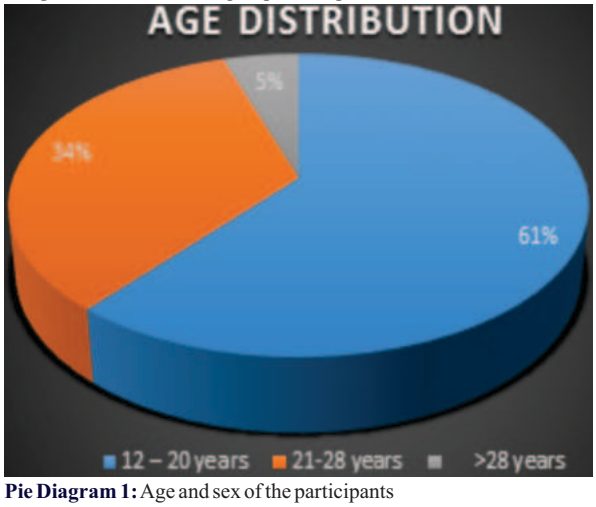


Figure 2: An orthopantomogram that displays the gonial angle, ramus height (Co-Go) on both sides, and body length (Go-Me). Markers represented: Go-Gonion, Me-Menton, and Co-Condylion

Statistical Analysis

Microsoft Office Excel 2010 was used for data entry, and version 22 of the Statistical Product and Service Solution (SPSS) would be used for any further result analysis. Descriptive statistics like standard deviation and mean will be computed for quantitative data. The p-value, or significance threshold, was established at 0.05. To assess data normality, the Shapiro-Wilk test was employed. For intergroup comparisons between two groups, an unpaired t-test was utilized.



Pie Diagram 1: Age and sex of the participants

Table 1: The Participants Age And Sex.

		Values (n=100)
Years of age	Mean ± SD	19.68 ± 4.79
	Range	20-22
Age group	12 – 20 years	61 (61%)
	21-28 years	34 (34%)
	>28 years	5 (5%)
sex	Men	50 (50%)
	Women	50 (50%)

RESULTS

100 patients' worth of data were examined for analysis, and no missing values were taken into account. Table 1 and Pie figure 1, illustrate the age range of the participants, which was between the ages of 20 and 22 aged, had a mean age of 19.68 ± 4.79 years. The distribution of participants was as follows: 34% were among the ages of 21 and 28, 5% were older than 28, and 61% were among the ages of 12 and 20. The participants were split equally by gender, with 50% of them being men and 50% being women.

The mean Gonial Angle in OPG Left showed 113.06 (5.23) degrees, for OPG Right it measured 112.34 (5.34) degrees, and in Table 2 and Graph-1 the mean Lateral Cephalogram was 127.75 (6.33) degrees. The left and right OPG did not differ statistically significantly, but there was a highly significant variation when assessing OPG both sides with the lateral cephalogram.

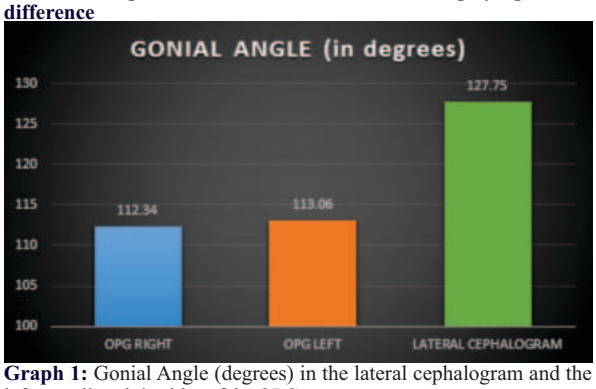
The mean mandibular ramus length was reported in Table 3 and Graph 2 as follows: 59.59 (8.31) mm for OPG Left, 58.89 (8.75) mm for OPG Right, and 49.93 (4.53) mm for the Lateral Cephalogram. Comparing the left and right OPG to the lateral cephalogram showed an extremely statistically significant difference; however, similar to the Gonial Angle, there was no significant difference between the left and right OPG.

Lastly, the mean measurement of the mandible was shown in Table 4 and Graph-3 as follows: 78.51 (14.54) mm for OPG Left, 77.51 (14.5) mm for OPG Right, and 63.46 (5.48) mm for the Lateral Cephalogram. The left and right OPG did not differ significantly from one another, similar to previous measurements; however, once both the left and right OPG were subjected to the lateral cephalogram, a substantial difference was seen.

Table 2: Gonial Angle (degrees) Between The Left And Right Sides Of The OPG And The Lateral Cephalogram

	OPG Right side Mean (SD)	OPG Left side Mean (SD)	Lateral Cephalogram Mean value (SD)
Gonial angle (Mean ± SD)	112.34 (5.34)	113.06 (5.23)	127.75 (6.33)
p value (OPG Left side vs Right side)	P = 0.278 (NS)		
p value (OPG Right side vs Lat. Ceph)	P < 0.001**		
p value (OPG Left side vs Lat. Ceph)	P < 0.001**		

P>0.05 – no significant difference **P < 0.001 – highly significant difference

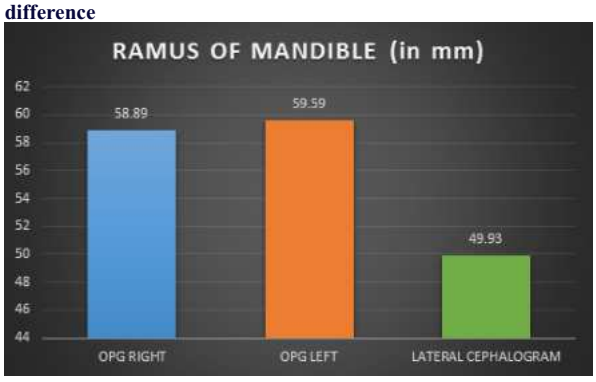


Graph 1: Gonial Angle (degrees) in the lateral cephalogram and the left as well as right sides of the OPG

Table 3: Mandibular Ramus (in Millimetres) In The Lateral Cephalogram, Right And Left OPG

	OPG Right Side Mean (SD)	OPG Left side Mean (SD)	Lateral Cephalogram Mean value (SD)
Ramus of mandible (Mean ± SD)	58.89 (8.75)	59.59 (8.31)	49.93 (4.53)
p value (OPG Left side vs Right side)	P = 0.274 (NS)		
p value (OPG Right side vs Lat Ceph)	P < 0.001**		
p value (OPG Left side vs Lat Ceph)	P < 0.001**		

P >0.05 – no significant difference **P < 0.001 – highly significant difference

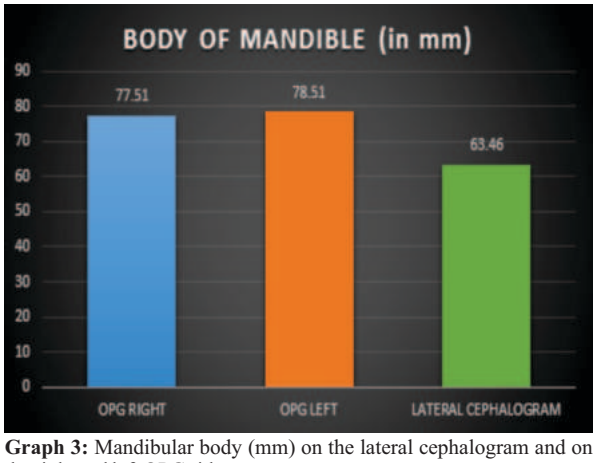


Graph 2: Mandibular body (mm) in the right and left OPG and lateral cephalogram

Table 4: Mandibular Body (mm) In The Right And Left OPG And Lateral Cephalogram

	OPG Right side Mean (SD)	OPG Left side Mean (SD)	Lateral Cephalogram Mean value (SD)
Body of mandible (Mean ± SD)	77.51 (14.5)	78.51 (14.54)	63.46 (5.48)
p value (OPG Left side vs Right side)	P = 0.093 (NS)		
p value (OPG Right side vs Lat Ceph)	P < 0.001**		
p value (OPG Left side vs Lat Ceph)	P < 0.001**		

P >0.05 – no significant difference **P < 0.001 – highly significant difference



Graph 3: Mandibular body (mm) on the lateral cephalogram and on the right and left OPG sides

DISCUSSION

The objective of this research was to contrast, in randomly chosen samples, the mandibular linear and angular measures obtained from lateral cephalograms and panoramic radiographs (OPG). While gonial measurement of angles in OPG have been the subject of several investigations, lateral cephalograms have not, there are very limited body of reported studies specifically addressing linear mandibular measurements in this context.

Research evaluating gonial angles on cephalograms, panoramic radiographs, and dry skulls was carried out in 1971 by Mattila et al. They discovered that the gonial angles measured on dry skulls and those obtained from panoramic photographs were identical[1]. This was denied by Larheim and Svanaes, who claimed that lateral cephalograms could not accurately register the gonial angle. The pictures that were layered made it impossible to identify and measure certain angles. Conversely, the gonial angle captured on the desiccated mandible matched that of a panoramic film rather well[2].

In research using dry skulls, Ongkosuwito et al. found that for linear mandibular measures, an OPG is equally reliable as a lateral cephalogram with vertical measurements showing greater correlation with horizontal ones[3]. According to Fischer Brandies et al. lateral cephalometric radiographs are preferred when figuring out the gonial angle[4].

Akcam et al. carried out a comparative analysis of angular measurements between panoramic radiographs (OPG) and cephalograms. They found that a lateral cephalogram is a more accurate technique than OPG for assessing the angular and vertical dimensions of cranial characteristics[5]. Shahabi et al. used simultaneous panoramic and lateral cephalograms to evaluate the external gonial angle in individuals categorized as Class I. They concluded that panoramic radiography was comparable to a lateral cephalogram and confirmed its accuracy in determining the gonial angle[6]. Araki et al.'s research revealed that the gonial angle readings on panoramic radiographs were slightly lower compared to those on lateral cephalometric radiographs[7].

In order to determine the real values obtained by direct skull measurements, Türp et al.'s study examined vertical linear measures obtained from panoramic images of 25 macerated skulls on the condyle and the ramus. The results from OPGs and the actual measurement of the skull showed no connection, according to the research[8].

Fatahi and Babouei undertook an examination of cephalometric data acquired via panoramic radiographs (OPG). The gonial angle exhibited the strongest relationship among panoramic and cephalometric radiographs, but the length of the mandibular body exhibited the lowest correlation when measurements taken from dry skulls were compared with radiographic measures[9].

Kurt et al. assessed mandibular asymmetry in patients with Class II subdivision malocclusion by measuring gonial angle including condylar, ramal, and ramal asymmetry index values utilizing OPGs. They came to the conclusion that panoramic radiography yields suitable findings in these sorts of evaluations[10].

Using panoramic radiographs, Nohadani and Ruf investigated longitudinal vertical alterations in the face and dentoalveolar structure and compared the results with measures from lateral cephalometric radiographs. They said that although OPG offers a reasonable approximation to the data shown in lateral cephalograms, it is not a suitable method for assessing the changes in vertical face parameters over time[11].

Using mathematical calculations, Tronje et al. determined the precision of panoramic measures and came to the conclusion that, when utilized appropriately, panoramic films may be utilized for vertical assessments in clinical practice, provided the patient is positioned within specific bounds. They did, however, also point out that the horizontal measurement is not accurate[12].

Panoramic radiographs may be used to evaluate total ramal height, according to research of Kambylafkas et al. The research did note, though, that there may be some cases of underdiagnosis using this method[13].

The findings of our investigation show that there is a significantly significant difference between lateral cephalograms and panoramic radiographs (OPG) in terms of gonial angle and ramus height. For body length, however, there is also a statistically significant variance between lateral cephalograms and OPG. As a result, OPG is able to determine the gonial angle as well as vertical measures on the right and left respectively. However, it could not be regarded as trustworthy when measuring horizontally.

In panoramic radiography, the nonlinear fluctuation in magnification at various object depths is the reason for the inaccuracy of horizontal readings. This imaging method uses a different focus for projection in the horizontal than in the vertical dimensions. The X-ray source is the functional focus in the vertical dimension, and the rotation center is the functional focus in the horizontal dimension. An object's, an X-ray source's, and the film's alignment, as well as the distances between them, all affect the form and size distortion of radiographic pictures in the vertical plane.

The vertical dimension is insensitive to the beam's rotation in the horizontal plane since the X-ray source functions as the functional focus. On the other hand, size and form distortion in the horizontal dimension is influenced by both motion and projection forces.

CONCLUSION

Comparing panoramic radiographs to lateral cephalograms, they provide a better diagnostic output on a single film, although they may not always measure horizontal and vertical dimensions with exact precision. This imaging technique shows a wider range of dental arches with the least amount of radiation exposure to the patients. Furthermore, panoramic radiographs could be a better option in situations involving asymmetry since they are a simpler method of evaluating the left and right sides without being interfered with by superimposed structures.

Clinicians should use care when extrapolating horizontal measures from panoramic radiographs, even though they are reliable for vertical and angular evaluations of the mandible. In conclusion, panoramic radiographs are an important diagnostic tool in dentistry practice even if they might not provide exact precision in some parameters due to their speed in delivering thorough information.

Conflict Of Interest Statement -

Regarding the research, writing, and/or publication of this article, the authors have declared that they have no potential conflicts of interest.

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Ethical Statement -

This article does not require approval from an ethical committee or patient consent because it is not a clinical study.

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