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ORTHOPANTOMOGRAM AN ALTERNATIVE TOOL IN EVALUATING VERTICAL FACIAL PATTERN

Orthodontology

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ABSTRACT

The aim was to assess the reliability of orthopantomogram in evaluating vertical facial pattern using gonial angle A cross-sectional study was conducted at the Department of orthodontics, Vokkaligara Sangha Dental College, by using 99 radiographs of the patients in the form of orthopantomogram and lateral cephalograms. The sample included 53 female and 46 male subjects. The subjects were divided into three groups-skeletal class I, class II and class III, each group comprising of 33 subjects. The gonial angle was traced manually by drawing a tangent to the posterior ramus and another tangent to the lower border of the mandible.The mean gonial angle was 110.86° on orthopantomograms and 111.34° on lateral cephalograms. The results prove that Orthopantomogram can be used as a valuable ancillary diagnostic tool for gonial angle evaluation without superimposition of anatomic structures.

INTRODUCTION:

Gonial angle is referred to as the angle formed by a tangent to the lower border of the mandible and a tangent touching the posterior border of the ramus at two points, one at the condyle and one at the angle region (Broca)[1]. The gonial angle varies from 100° to 148°[1]. The mean gonial angle in males is 3° to 5° lower in comparison to females[1].

Gonial angle is an important landmark of the craniofacial complex[2]. It is a dominant cephalometric parameter in assessment of vertical growth patterns, rotation of the mandible, assessment of extraction pattern in class II patients, depict the form and shape of the mandible, , estimate age in forensic sciences and detect facial asymmetry[2,3,4,5,6,7].

In order to initiate orthodontic treatment, essential diagnostic aids are mandatory. Case history, clinical examination, study models, photographs and radiographs are the essential aids .Out of the radiographs –Lateral cephalograms and Orthopantomograms are routinely taken for every patient.

Panoramic radiography was first launched in the year 1961 and is considered standard care for diagnosis and treatment planning[4,5,7]. It provides us adequate information about teeth, supporting bone and soft tissues, maturational periods, axial inclinations, tooth anomalies, bone pathology, sinuses and asymmetry of the mandible[2,3,4,5,6]. Panoramic radiographs also overcome the double image of the lower border of the mandible that is visualised on lateral ceohalograms[5]. The right and left gonial angle can be separately studied without complications due to the absence of superimpositions[2,3,4].In order to overcome difficulty in assessing gonial angle through lateral cephalograms, the need was felt to compare the accuracy of gonial angle values on orthopantomograms and lateral cephalograms .

MATERIAL AND METHODS:

This cross sectional study was carried out at Department of Orthodontics, Vokkaligara Sangha Dental College and Hospital, Bengaluru. The records of 99 patients in the form of orthopantomograms and lateral cephalograms were obtained. The sample included 53 female and 46 male subjects with the mean age of 16.28 and 16.96 years respectively. 3 groups were made on the basis of the following inclusion criteria:
GROUP 1-Class I skeletal malocclusion
GROUP 2-Class II skeletal malocclusion
GROUP 3-Class III skeletal malocclusion

Lateral cephalograms and orthopantomograms of the individual patient were exposed under standard conditions. On a cellulose acetate matte gonial angle was traced on orthopantomogram and lateral cephaograph using a good quality view box. The gonial angle was measured by drawing a tangent to the posterior ramus of the mandible and condyle and another tangent to the lower border of the mandible[2,8,]

[9]. The point of intersection was measured as gonial angle.

RESULTS:

The sample size was calculated for each group as 16, based on alpha significance level of 0.05, effect size of 0.59 (calculated from the study Mandeep Kaur et al[4]) and power of 95%. Descriptive statistics was carried out .The mean values obtained were calculated using paired't' test. Statistical significance is considered at p<0.05. The mean value of gonial angle on the lateral cephalograms was 111.34° and on panoramic radiographs was 110.86°. (Table: I).Hence, no statistical significant differences were found between the gonial angle measured using lateral cephalograms and panoramic radiographs. Pearson's correlation co-efficient for gonial angle on OPG and lateral cephalogram revealed a striking correlation with r = 0.908. (Table: II)Also, a significant correlation was seen in gonial angle values between OPG and lateral cephalograms based on gender and malocclusion using Pearson's correlation co-efficient (Table :III).

DISCUSSION:

The gonial angle is an important landmark used to assess the shape and form of the mandible, forecast the growth pattern of an individual, determine extraction pattern in class II patients, decide the need for surgery in class III skeletal base patients, estimate age in forensic medicine, and assess profile changes[2,3,4,5,6,7].

In the study conducted by Girish Katti et al, gonial angle was assessed only for class I malocclusion patients. No statistical significant differences were observed in gonial angle values measured using OPG and lateral cephalograms. In addition, gender also did not have a considerable effect on both radiographs which was in accordance with our study revealing that unpaired't' test showed no statistical difference between male and female patients with respect to OPG and lateral cephalograms. He concluded that OPG is a better choice to assess gonial angle in comparison to lateral cephalographs as there is absence of superimposition[2].

According to Pillai Devu et al, the outline of the gonial angle of right and left side are not clearly visible on lateral cephalogram whereas in OPG the two sides can be easily visualized because there is no superimposition of images. Thus, OPG was considered a reliable tool to measure gonial angle. Also, no statistical significant differences were observed between the gonial angles measured using lateral cephalograms and panoramic radiographs which was in accordance with the results of our study. The mean value of gonial angle on the lateral cephalograms was 111.34° and on panoramic radiographs was 110.86° from our study. Also, no statistical differences were observed in relation to gender[3].

According to Mandeep Kaur Bhullar et al, no statistically significant differences in the values of gonial angle measured on cephalogram and

OPG were observed. They concluded that OPG is as accurate as lateral cephalogram to measure gonial angle. They also added that OPG is now an additional tool to assess gonial angle and is a better choice that lateral cephalogram for the same purpose[4].

In the study conducted by Tayyaba Bibi et al, a high correlation between the values of gonial angle obtained from OPG and lateral cephalograms was obtained. No difference in values was observed based on gender. They concluded that OPG is a reliable and important diagnostic tool in measuring gonial angle. However, it can only be used as an alternative tool, but cannot substitute lateral cephalogram based on information content[5].

According to Zangouei-Booshehri et al, no statistical differences between the mean gonial angles in different age groups, genders or type of malocclusion from the two different types of radiographs was observed. This was in accordance with our study which signified that no statistical differences were seen in gonial angle value measured on OPG and lateral cephalogram based on age. They concluded that panoramic radiographs are accurate, simple, and inexpensive, it should be used to measure the gonial angle more frequently[6].

According to Ibadullah Kundi, no statistically significant differences were found when right and left side gonial angle were measured and compared on OPG. But, panoramic measurements (right and left) when compared to lateral cephalometric measurements were not equal. Hence, contradicting our results[7].

According to Mattila et al, the size of the gonial angle is based on the method of measurement used. In this study, to avoid any inexactness in measuring the horizontal plane of the gonial angle, a line was drawn tangentially to the lower border of the mandible in both OPG and lateral cephalograms. Gonial angle measurements were made on dry skulls, OPG and lateral cephalograms. Statistical differences were observed in gonial angle values.

OPG assessment of gonial angle was proved to be more accurate[10,11].

According to Akcam et al, even though panoramic radiographs provide sufficient information on the vertical dimensions of craniofacial structures, it is important for clinicians to be vigilant when predicting skeletal cephalometric parameters from panoramic radiographs because of their lower predictability. No statistical significant differences were found in gonial angle values measured using OPG and lateral cephalograms[12].

According to Fisher-Brandies et al, the gonial angle obtained from OPG was 2.2-3.6° less than that of lateral cephalogram. He said that statistical significant differences were observed between gonial angle values on OPG and lateral cephalogram and concluded that lateral cephalogram was a more reliable tool to assess gonial angle[13].

According to Larheim et al and Bhullar et al no statistical significant differences were observed in gonial angle value between OPG and lateral cephalograms[14,15].

According to Araki et al, the gonial angle values were slightly smaller on the panoramic radiographs when compared to lateral cephalograms[16].

In the study conducted by Shahabi et al, external gonial angle of class I patients were compared on OPG and lateral cephalograms. They concluded that OPG was as accurate as lateral cephalogram to measure gonial angle[17].

According to Huumonen et al, Xie et al, Ghosh et al, Bhardwaj et al gonial angle was larger in female patients on comparison with male patients. They also added that this difference in values may be due to the consideration that female masticatory forces are higher[18,19,20,21].

According to Nohadani and Ruf, angular values from OPG are more reliable, as the angular values in the posterior and the lateral aspects of the mandible are not affected by the image distortion inherent to panoramic radiography[22].

Alhaija et al conducted a study to evaluate the potential of panoramic radiographs to measure mandibular steepness and inclination. They observed a high correlation in values obtained using OPG and lateral

cephalograms. They concluded that panoramic radiographs are useful to determine the gonial angle, are good indicators of mandibular steepness and are also useful to assess mandibular growth direction[23].

According to Jena et al OPGs can be used to make vertical and angular measurements as well as evaluate mandibular asymmetry[24].

According to Ongkosuwito et al OPG is as reliable as a lateral cephalogram to make linear mandibular measurements, i.e. condylion-gonion, gonion-menton and condylion-menton[25].
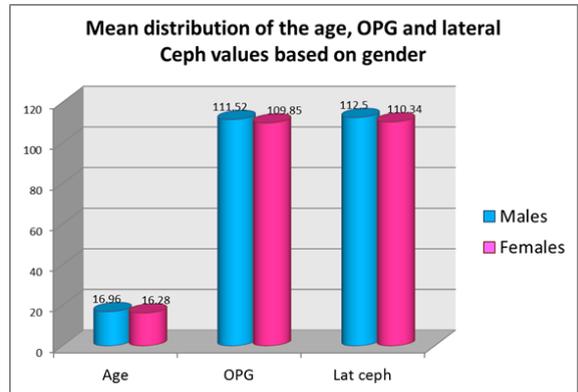
Table: I

Mean distribution of the age, OPG and lateral Ceph values based on gender

Table: II

Paired t test	t value	p value	
Overall	-2.02	0.052	
Based on malocclusions and gender	Gender	t value	p value
Class 1	Females	-3.495	.003*
	Males	-1.270	.225
Class 2	Females	1.980	.065
	Males	-3.334	.005*
Class 3	Females	-.682	.504
	Males	.383	.708

*significant

Table: III

Pearson's correlation	r value	p value
Overall (OPG * Lateral Ceph)	.908	.000*

*significant

CONCLUSION:
From the above study we can conclude that:
- OPG is a valuable ancillary diagnostic tool for gonial angle evaluation without superimposition of anatomic structures.
- Panoramic radiographs are as reliable as lateral cephalograms to assess gonial angle.
- Overall, No statistical significant differences were seen in gonial angle values between orthopantomograms and lateral cephalograms.

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