ORIGINAL ARTICLE POJ 2020:12(2) 114-117

Accuracy of panoramic radiographs and lateral cephalograms in determination of external gonial angle of adult patients with class I skeletal pattern

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Abstract

Introduction: In dentistry worldwide, for planning Orthodontic treatment and Orthognathic surgery, the measurement of Gonial angle is incredibly important. In cephalometric radiographs, the influence of underlying anatomical superimposition makes it troublesome to measure the gonial angle precisely. Orthopantomogram (OPG) could be an accurate alternative investigating source to measure right and left gonial (mandibular) angle precisely. Hence the objective of the present study was to determine the accuracy of panoramic radiographs and lateral cephalograms in determination of external gonial angle of adult patients with class I malocclusion.

Material and Methods: 273 OPG and 273 lateral cephalograms of skeletal class 1 patients aged 13 to 23-year, having class I malocclusion were traced for the gonial angle. The comparative analysis was done using Pearson's correlation coefficient and paired t-test.

Results: On lateral cephalogram and OPG, Gonial angle was measured to be 123.85 ± 7.564 and 123.77 ± 7.452 degrees respectively. The difference of measurement obtained from lateral cephalogram and OPG was insignificant, and there were insignificant results found among the values of gonial angle measured on Right and Left side of the mandible individually on same OPG.

Conclusions: Measuring the gonial angle on both OPG and Lateral cephalogram has insignificant difference, hence enabling the use of an OPG radiograph as an alternative x ray for determining gonial angle precisely. Moreover, gonial angles of the right and left sides of the mandible can be measured individually on an OPG radiograph and is not influenced by underlying superimposed anatomical structures as in a lateral cephalogram.

Keywords: Cephalometric analysis; orthodontics; orthopantomogram

Introduction

Orthopantomogram (OPG) is being used widely in orthodontics to gather information regarding unerupted, missing, inclination, supernumerary teeth. Stages of tooth development, cysts and pathologies related to mandible and temporo-mandibular joint TMJ can also be ascertained on an OPG x ray. Lateral cephalogram are used for orthodontic diagnosis and treatment outcomes.[1,]

Mandibular angle or angle of the jaw are other widely used names for the gonial angle. The lower border of the body of the mandible unites the posterior ramal boarder at this angle. The mandibular (gonial) angle is an

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important angle used in orthodontic diagnosis and treatment planning ascertaining the vertical facial pattern and dentofacial dysmorphology.[2]

Lateral cephalogram has been used historically for Orthodontic diagnosis and treatment outcome. This method of measurement has limitations due to superimposition of right and left overlapping structures.[3] Few researchers found that there was a huge difference in mandibular angle measurements obtained by the two aforementioned types of radiographs.[4] Contrary to this it has been found that distortion of gonial (mandibular) angle measured from OPG puts a question mark on its accuracy.[6]

Present study shows the comparison of gonial angle determined by the two radiographic methods i.e. lateral cephalogram and panoramic (OPG) radiograph. The purpose of this study was to find out the accuracy and precision of the measurement of gonial angle.

Material and Methods

This was a cross-sectional study using panoramic x rays and lateral cephalograms. Ethical permission was sought from the committee of University. A total 273 sample size was calculated using the Raosoft online software. 273 OPG and lateral cephalograms were traced for this study. These were of patients aged between 13 to 23 years seeking orthodontic treatment from Orthodontics Department of Dow University of Health Sciences (DUHS), Karachi. Included patients had mild orthodontics problem with skeletal class I malocclusion. Patients having history of orthognathic surgery, dentofacial asymmetry and syndromes were excluded from the sample. Radiographs having artifacts were not included in this study. OPG and lateral cephalograms were taken by the same operator/machine in Natural Head position (NHP) at the Orthodontics Radiology Department of DUHS, Karachi.

Angle formed by the union of ramus axis (Ar-Go) and mandible axis (Go-Gn) were traced on matte surface of cellulose acetate tracing sheets of 8 *10-inch size. Senior Orthodontic resident recorded the measurements of gonial (mandibular) angle of the mandible on OPG and lateral cephalograms skeletal pattern antro posteriorly i.e. Class I malocclusion, was based on SNA, SNB and ANB recorded on patient's lateral cephalogram. SPSS-16 was used for data analysis. Paired sample t-test and Pearson's correlation coefficient was used. The P <0.05 probability level was considered as significant statistically.

Results

The mean value measured for gonial angle was 123.85° on the lateral cephalograms with 7.564° of standard deviation. 123.77° was the mean gonial (mandibular) angle on OPG x-rays having 7.452° of standard deviation. 123.73° was the mean right gonial (mandibular) angle value on OPG's with 7.571° of standard deviation. 123.79° was the mean left gonial (mandibular) angle having 7.375° of standard deviation.

These comparative values showed no significant statistical difference (P = 0.112, Table II). Moreover, panoramic radiographs revealed insignificant difference between the right and left sided gonial angles (P = 0.689). This study reflects that the difference of 0.19° in the Mean values of gonial (mandibular) angle of the mandible in both radiographic methods with P < 0.05 is not significant statistically. Hence, with 95% confidence interval, the mean of differences between the two different radiographic measurements shows acceptable agreement.

Discussion

This research was undertaken to compare the values obtained by measurement of the gonial (mandibular) angles on two radiographs i.e. OPG and lateral cephalograms. The sample constituted skeletal class I patients aged between 13-23 years. Assessment of right and left gonial angle on OPG makes it easy to assess the measurements precisely pre and

post orthodontic treatment and pre and post orthognathic surgery.[5,6]

The present study showed no significant statistical difference between the measurements of the same angle done on two different radiographs. Contrary to this Updegrave et al[7] reported significant difference between the angles. This could be due to different genetic growth pattern of the population under investigation. Matilla reported that reliability of the mandibular angle measured on OPG is same as that of lateral cephalogram [6].

Larheim and Svanaes concluded from their work that lateral cephalograms and OPG were reliable for measuring the gonial angle and also found no significant difference among measurements obtained from the right and left side panoramic radiographs.8

Other researchers have found that gonial angle measured on panoramic radiographs are as accurate for precise measurement as lateral cephalograms and the right and left gonial angles are not influenced by anatomical superimpositions as in lateral cephalograms.[9,]

Fisher-Brandies et al concluded that statistical significant difference exists in the measurement of gonial (mandibular) angle obtained by two radiographic methods. In their study, the gonial angle obtained by OPG was on an average 2.2 - 3.6 degrees less as compared to lateral cephalogram contrary to the present study. The observed differences may be due to difference of population.[17] This study shows insignificant difference (*P* =0.689) among the right and left gonial (mandibular) angle measurements.[18]

Conclusions

Measurement of gonial angle can be performed on panoramic radiographs as precisely as on lateral cephalograms. The right and left gonial angles are similar in values when measured on OPG x-ray because of absence of anatomical superimpositions that being a short coming of lateral cephalograms. OPG can be an alternative for measuring gonial (mandibular) angle on both sides of the mandible individually

Table I: Comparison of gonial angle in degrees measured in images obtained by lateral cephalometry and on both sides (Rt. & Lt.) of the mandible in OPG.

VARIABLES	MEANS	STANDARD DEVIATION	RANGE
Gonial (mandibular) angle in cephalogram	123.85^0	7.564	107^0-139^0
Gonial (mandibular) angle in OPG	123.77^0	7.452	107^0-139^0
Gonial (mandibular) angle in OPG Right side	123.72^0	7.571	107^0-138^0
Gonial (mandibular) angle in OPG Left side	123.78^0	7.375	108^0-139^0

Table II: Gonial angle comparison in (i) Lateral Cephalometric image and (ii) OPG

Variables	Mean difference	P-value
Gonial (mandibular) angle in Lateral cephalometric image and OPG.	0.19^0	0.112
Gonial (mandibular) angle on (Rt. and Lt. side) of mandible in OPG.	0.06^0	0.689
Gonial (mandibular) angle on (Rt .side) of mandible in OPG and Lateral Cephalometric image.	0.22^0	0.112
Gonial (mandibular) angle on (Lt. side of mandible in OPG and Lateral Cephalometric image.	0.169^0	0.301

Table III: Value of Correlation coefficient in measurement of gonial (mandibular) angle (Rt. and Lt. Side) of mandible on OPG and Lateral Cephalometric images.

Variables	Correlation coefficient by Pearson	P-value
Gonial (mandibular) angle of (Rt. and Lt. side of) mandible in OPG	0.983	0.01
Gonial angle of Left side of mandible in OPG and Cephalogram	0.979	0.01
Gonial angle of right side of mandible in OPG and Cephalogram	0.984	0.01

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