

Determination of the Gonial Angle from the Orthopantomogram

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Orthodontic measures and procedures in jaw surgery always require thorough radiographic investigation. The procedures generally employed are orthopantomography and cephalostatic examinations.

Lateral and anteroposterior projections are mostly used when cephalometric measurements are made from radiographs.^{4,5,8,9,10} However, because of the superimposed images appearing on the lateral cephalograms, reliable measuring of the individual gonial angles becomes very difficult, particularly when planning any type of jaw surgery. This disadvantage is not encountered in orthopantomography which is being used increasingly for skull examination.

How reliable the cephalometric measurements are when determined from an orthopantomogram is a question which has been of much interest to investigators.^{1,6,7} Generally, patient radiographs have been used for comparison purposes, although purely experimental measurements have also been made.²

The size of the gonial, or mandibular angle, depends on the method of measuring being used, i.e., whether the horizontal side of the gonial angle is formed by the tangent of the lower border of the mandible¹ or by the straight line passing through gnathion.⁶ Both planes can be easily determined from a lateral cephalogram, whereas the determination of gnathion from an orthopantomogram involves possible inaccuracy in the gonial angle. Alter-

natively, the tangent of the lower border of the mandible can be used as a mandibular plane. This is easily identified on the resulting radiographs of both methods and can therefore be considered acceptable as a basis for comparing the gonial angles.

In the present study the investigators have observed the size of the gonial angle through separate measurements taken from both lateral cephalograms and orthopantomograms. From these comparisons, efforts have been made to clarify the possible application of orthopantomograms as a means for cephalometric measurement.

MATERIAL AND METHODS

Part I

Using a dry skull, the size of the gonial angle was studied from the radiographs of various orthopantomographic projections. These were then compared with the values obtained from lateral cephalograms as well as the angles measured directly on the skull. Since the size of the gonial angle may be influenced by the location of the mandible as seen on the orthopantomogram, nine different exposures were made as follows:

The position of the occlusal plane was horizontal, inclined upward 10°, or downward 10° with the mandible positioned normally, 10 mm forward, or 10 mm backward.

In each exposure efforts were made to situate the sagittal plane of the lower jaw exactly on the midline. The median plane of the human facial skeleton, however, may deviate from the calculated midline of the machine. There-

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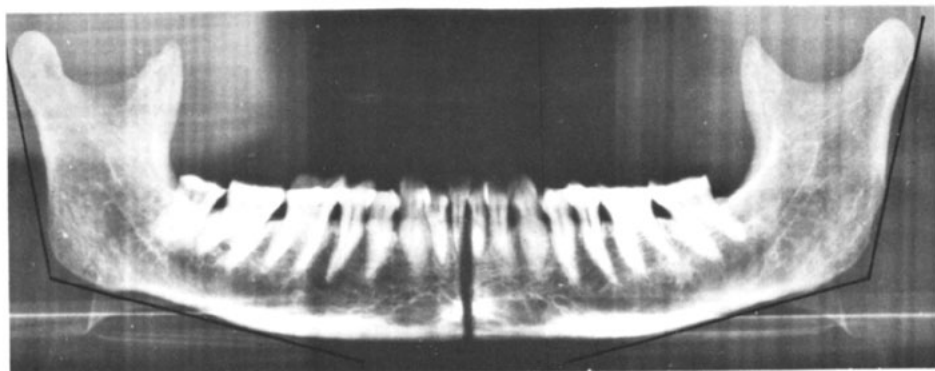


Fig. 1

fore, to demonstrate any possible error between exposures, the midline of the lower incisors was transferred ± 3 mm from the midline of the machine, while the condyles remained at the same distance from the midsagittal plane. To establish the extent of possible projection alteration caused by different gonial widths, the mandible was cut off and the width of the jaw artificially varied by ± 6 mm. This corresponded approximately with the mean gonial width in various age groups³ and with the age distribution described in Part II.

Part II

A series of 601 patients aged from 5 to 20 years was investigated. A lateral cephalogram and an orthopantomogram were made of each patient. The sex of the patient was not taken into consideration as only the exposure procedures were to be compared.

Tracings were made of all the radiographs in which the gonial angles were formed by drawing one line tangent to the lower border of the mandible and another line tangent to the distal border of the ascending ramus and the condyle on each side (Fig. 1).

In the lateral cephalogram the mean of the gonial angles in the superimposed projections was calculated. An accuracy of measurement of 0.5° was used.

RESULTS AND DISCUSSION

Part I

Results of the experimental part of this study are presented in Table I. The radiographic and measurement procedures were performed twice. Separate results are shown for the right and left halves of the jaw plus the mean of both lateral cephalograms and orthopantomograms.

Table I shows that in orthopantomograms the measurement values of the right and left gonial angles conform with the angles measured from the dry skull. The mean values taken from the orthopantomograms, especially of "normal" gonial width, give quite accurate results. Comparing the mean of gonial angles between lateral cephalograms and orthopantomograms, it can be concluded that the measurement values of orthopantomograms are more accurate.

Generally speaking, there is no marked difference between the different exposure positions and the different gonial widths in the appearance of the gonial angles. The slight variations in the gonial angles between different gonial widths may be caused by projection deviation of the anatomical structures, particularly at the site of the condyles. In addition, the sizes of the gonial angles are similar in both radiographic methods. The ± 3 mm shifting of the midline of the mandible from

TABLE I

<i>Gonial Width — Normal</i>	<i>Gonial Right</i>	<i>Angle Left</i>
Dry skull measurement	119.0	120.0
<i>Orthopantomogram</i>		
Horizontal occlusal plane		
Position of mandible		
a) normal	120.0	120.5
b) 10 mm forward	120.0	120.5
c) 10 mm backward	120.8	121.5
<i>Orthopantomogram</i>		
10° upward occlusal plane		
Position of mandible		
a) normal	118.5	119.0
b) 10 mm forward	118.3	119.5
c) 10 mm backward	119.0	120.5
<i>Orthopantomogram</i>		
10° downward occlusal plane		
Position of mandible		
a) normal	120.0	121.0
b) 10 mm forward	119.0	120.5
c) 10 mm backward	119.5	121.0
Orthopantomogram Mean	119.4	120.4
Cephalogram Mean	120.0	
<i>Orthopantomogram</i>		
Lower jaw midline shifted		
3 mm right	120.0	120.5
3 mm left	119.5	120.0
Gonial width plus 6 mm		
Orthopantomogram normal	118.0	119.0
Cephalogram mean	119.0	
Gonial width minus 6 mm		
Orthopantomogram normal	120.0	121.0
Cephalogram Mean	120.0	

the calculated midline of the machine has no significant influence on the size of the gonial angle with the 0.5° accuracy of measurement used.

Part II

The means of the gonial angles

measured from the orthopantomograms and lateral cephalograms of the 601 patient series are described in Table II according to age groups.

On the basis of Table II, it can be concluded that the measurement values taken from both the orthopantomograms and the lateral cephalograms are quite similar in all age groups including the slight decrease in the gonial angle with increasing age. In addition, there is no difference in distribution of standard deviations which would suggest favouring one procedure over the other.

CONCLUSION

This study demonstrates that the size of the gonial angle can be determined from the orthopantomogram with the same degree of accuracy as from the generally used lateral cephalogram, the gonial angle being formed by the tangents of the lower border of the mandible and the distal border of the ascending ramus and the condyle on each side.

It also shows that the right and left gonial angles can be quite easily determined individually from orthopantomograms, thus avoiding the disturbing influence of the superimposed images found on lateral cephalograms.

It proves conclusively that the orthopantomogram is the more obvious choice for determination of the gonial angles.

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TABLE II

<i>Age</i>	<i>No.</i>	<i>Optg. Right</i>	<i>Optg. Left</i>	<i>Cephalogram</i>
5.0-10.9	202	131.9	131.3	132.2
11.0-15.9	268	129.3	129.0	129.9
16.0-20.0	131	128.0	127.6	128.6
	601			
Mean		129.8	129.4	130.4
Stand. Dev.		6.45	6.41	6.12

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