Evaluation of Gonial Angle, Ramus Height and Bigonial width in Relation to Age and Gender using
Digital Panoramic Radiograph

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Abstract

Background: Age and gender have important effect on Gonial angle, ramus height and bigonial width.

Objective: To evaluate the changes in gonial angle, bigonial width and ramus height measured from panoramic radiographs, in relation to age and gender.

Patients and Methods: Fifty digital panoramic radiographs were evaluated (25 male and 25 female). The patients classified into 5 groups according to age, starting from 20 years old to 60 years and above with ten years interval . The gonial angle, ramus height and bigonial width were measured by digital panoramic radiographs by using Planmeca Romix software program.

Results: Gonial angle, ramus height and Bigonial width increased with age. Gonial angle of the left side was greater than the right side and females had larger gonial angle compared to male. The measurements show that the ramus height was greater on the right side than the left side, greater ramus height and bigonial width in male patients.

Conclusion: Gonial angle, ramus height and bigonial width are the most important and widely used radiographic landmarks in orthodontic tracing for evaluation of growth pattern and treatment planning. It's also used as a basic reference for forensic dentistry and for comparison with other nationalities and races.

Keywords: Bigonial width, gonial angle, ramus height , digital panoramic radiograph.

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Introduction

The largest, strongest and lowest bone in the face is the mandible[1]. Gonial angle is an indicator of mandibular plan steepness and could be used for predicting facial growth pattern. This angle forms between two lines, one come in contact with inferior border of mandible and the other is line tangent to ramus and condyle and indicates the mandibular shape according to the relationship between body and ramus[2].

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Great changes in mandibular bone associated with age progression can be noticed. Ramus remodeling casue changes in face shape in general and particularly in the gonial angle which is largely pronounced and its depend on the remodeling direction of the ramus in relation to its condyle. There were few studies correlate the changes in the mandibular angle with age, gender and dental status [3]. Bigonial width is the distance between the right and left gonial angles and represents the horizontal dimension [4]. Ramus height can be demonstrated by drawing a perpendicular line draw from the highest point of the con¬dylar head to the lowest point of ramus[5].

Panoramic radiograph has become very popular in dentistry, the main reason for this include: the technique is simple and the radiation dose is relatively low. The resultant film is a sectional radiograph produced by moving equipment and like all forms of tomography, only structures within the section (focal trough) will be evident and in focus on the final film[6]. Panoramic radiograph is the most obvious choice for determination of the mandibular structures with minimum radiation dose[3].

The objective of this study was to evaluate the changes in mandibular parameters including (gonial angle, bigonial width and ramus height) in relation to age and gender.

Patients and Methods

Fifty digital panoramic radiographic were selected from the archive of radiology clinic in diagnosis department/College of Dentistry/ University of Baghdad. Twenty five radiographs for males and twenty five for females, with age ranged from 20 years to 70s and the sample classified into five age groups with ten year interval, each group had 10 patients (5 males and 5 females). The first age group (20-29i) years, the second age group (30i-39) years, The third age group (40i-49) years, The forth age group (50-59) yearsi, The fifth age group (60-above) years and each forms 20% of the sample. Patient with craniofacial deformities and fracture of the mandible were excluded.

The panoramic x-ray machine was used in this study is Dimaxi 3 digital X-ray machine manufacturedi by Planmeca, Helsinki, Finland. The panormic machine was supplied with sensor which is responsible for transferring digital image to the computer unit (DELL) to be able to manipulate with the software program. Gonial angle was measured according to Upadhyay *et al.* [7] method. Two line had been drawn one of them come in contact with mandibular ramus and the other was in contact with the inferior border of the mandible, the angle formed by these two line was measured as gonial angle. This angle measured for both side of each panoramic radiograph. Ramus height was measured according to Saini *et al.* [5] method by drawing a line from the highest point of the con¬dylar head to the lowest point of ramus , and its measured bilaterally. Bigonial width was measured according to Lux *et al* [8] method by measuring the horizontal distance between the left and right gonion . all measurements were showed in Figure(1).

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Statistical analysis

Statistical analysis was performed using SPSS program ,mean ,Standard deviation, standard error, 95% confidence interval were

evaluated and 2 tail T test was used to assess the difference between groups. P value was used to assess the statistical significant differences between groups measured.
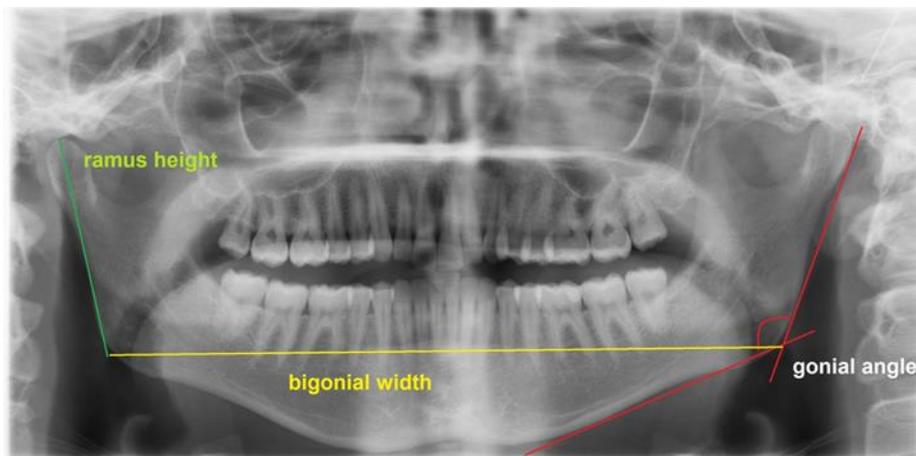

Figure (1): Gonial angle, ramus height and bigonial width as measured by digital panoramic radiographs

Results

In this retrospective study, Fifty radiographs were evaluated .By evaluating the differences in ramus height, bigonial width and gonial angle in relation to gender, higher values of ramus height and bigonial width than female can be noticed while higher gonial angle detected in female. These results shown in details in Table (1).There

was no significant difference in the mean of ramus height on both side but the gonial angle was slightly higher on left side, these differences were shown in Table (2).

According to age groups, mean of gonial angle , bigonial width and ramus height had a positive correlation with age, these values increased with the age progression.as shown in Table (3).

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Table (1): measurements of bigonial width, ramus height (by mm) and gonial angle in relation to gender (with 2tail t-test)

| | male | | | | | | | Female | | | | | | | p-value |
| | N | Mean | SD | SE | 95% conf. limit | | range | N | Mean | SD | SE | 95% conf. limit | | range | |
					lower	upper						lower	upper		
Bigonial width	25	210.9	1.53	0.3	204.6	217.2	180-240	25	208	1.34	0.26	202.5	213.6	175-230	0.48 NS
Ramus height	25	76.1	0.9	0.18	72.4	79.9	60-95	25	70.1	0.57	0.11	67.7	72.5	58-80	0.007 HS
gonial angle	25	122.6°	7.6	1.52	119.4°	125.7°	107-138 °	25	125.5°	5.3	1.06	123.3°	127.7°	117-138 °	0.11 NS

Table (2): Comparison of gonial iangle and iramus height values between two sides

| | left | | | | | | | Right | | | | | | | p-value |
| | N | Mean | SD | SE | 95% conf. limit | | range | N | Mean | SD | SE | 95% conf. limit | | range | |
					lower	upper						lower	Upper		
Ramus height	50	73.3	0.79	0.11	71	75	58-95	50	73.3	0.72	0.1	71.2	75.3	60-95	0.98 NS
gonial angle	50	124.08°	6.66	0.94	122.19°	125.97°	107-138°	50	123.98°	6.76	0.9	122.08°	125.08°	110-138°	0.94 NS

Table (3): Measurements of mandibular parameters in relation to age

| | Bigonial width | | | Ramus height | | | Gonial angle | | |
	mean	SD	range	mean	SD	Range	mean	SD	Range
20-29	208.5	1.34	180-230	71.2	0.96	58-89	121.1°	6.04	107-127 °
30-39	210.6	0.95	195-225	73	0.6	65-85	124.4°	8.73	110-138 °
40-49	200.1	1.26	175-220	70.8	0.63	65-80	122.9°	2.96	120-128 °
50-59	212.7	1.8	195-240	76.2	0.69	65-90	124.6°	5.64	115-132 °
60- above	215.7	1.43	190-235	75.3	1	65-95	127.4°	8	115-138 °

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Table (4): Comparison of gonial angle ,bigonial width and ramus height by independent sample 2-tailed T-test for different age groups

	age	20-29	30-39	40-49	50-59
bigonial width	30-39	pi= 0.69			
	40-49	pi<0.0001	pi=0.05		
	50-59	pi<0.0001	pi<0.0001	pi<0.0001	
	60 - above	pi<0.0001	pi=0.36	pi<0.0001	pi<0.0001
ramus height	30-39	pi<0.0001			
	40-49	pi=0.91	pi<0.0001		
	50-59	pi<0.0001	pi<0.0001	pi=0.08	
	60 - above	pi<0.0001	pi<0.0001	pi=0.24	pi=0.81
gonial angle	30-39	pi<0.0001			
	40-49	pi=0.4	pi<0.0001		
	50-59	pi<0.0001	pi<0.0001	pi<0.0001	
	60 - above	pi<0.0001	pi<0.0001	pi<0.0001	pi<0.0001

Discussion

In this retrospective study , mandibular parameters were performed in different age groups to detect the changes in relation to age in addition to gender differences. The study shows that gonial angle increased in size with age (larger and flare angle in older age group compared with younger age group), this result agreed with many previous studies [4, 9, 10]. There was disagreement with the results of Ubadhyay *et al* [7] ,they found that the goniali angle was decreased with advancing age.   This may be due to differences in sample size, age ranged, race, the method of measurements and the radiograph type. Many authors [3, 9, 10, 11 ,12] reported that females have larger (wider) gonial angle than male in all age groups, These results were inconformity with the result of the present study, but was not agreed with others [4,7,13] they found that no correlation of gonial angle with gender, or males have wider gonial angle, this may be

due to differences in sample size, sample ratio and race. By comparing the gonial angle of right and left side, the results shows greater angle in the left side for both genders and all age groups. The result of present study agreed with Leversha *et al* [10]. But the results of this study disagreed with the results of other studies [4, 14] which found that the right side was greater; this may be due to differences in sample size, race and method of measurement. There are limi¬ted researches measuring the differences in ramusi height and bigoniali width in relation to gender and age. The present study showed that males had a higher ramus in comparison to females; this was agreed with many researchers [4, 10, 11, 15]. Others reported that there was a steady decrease in ramus height later in life, this disagree with the result of the present study and this may be due to differences in sample size, age range, distribution age group and race. By comparing the ramus height of right and left

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side, the results shows greater height in the right side for both genders and all age groups this was agreed with studies[4, 10, 14]. The present study showed that bigonial width was increased with age, this agreed with Al shamout etal and Huumoneen *et al* [4,14], but disagreed with Laversha *et al* [10] who found there was a steady decrease in bigonial width with increasing age, this disagreement may be due to differences in sample size, age range, group distribution and ethnicity. The result of present study showed that bigonial width in average was higher in males than females which agree with Al shamout et al and Laversha *et al* [4, 10].

Conclusions

Digital panoramic radiograph is a valuable tool for the evaluation of different mandibular parameters for detection of morphological changes associated with age and gender. Goniall angle, ramuss height and bigoniall width are one of the most important and widely used radiographic landmarks in orthodontic tracing for evaluation of growth pattern and treatment planning. Evaluations of these landmarks are of great importance as a basic reference for forensic dentistry and also for comparison with other nationalities and races.

1-Gonial angle degree increased with age and it was larger in female and left side.

2-Ramus height was larger in male than female and in right side than left side and increased with age.

3-Bigonial width was larger in male and increased with age .so the mandible increased in size collectively with age.

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