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Panoramic Radiographic Evaluation of the Osseous Morphological Changes in Iraqi Patients with Chronic Renal Failure

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Key words
Panoramic radiograph ,chronic renal failure, dialysis, mandibular canal wall.

Abstract

To make comparative evaluation of gonial cortical bone thickness, antegonial index, gonial angle values and mandibular canal bone resorption, pathologies like ground-glass appearance in jawbones and brown tumor in Iraqi patients undergoing dialysis due to chronic renal failure and patients from the healthy control group on panoramic .Panoramic radiographs were taken from 40 patients divided into two groups (20 normal and 20 dialysis patients) .Gonial cortical thickness, antegonial index and gonial angle values with the mandibular canal wall resorption were assessed , pathologies such as ground-glass appearance and Brown tumor as "available" or "not available." Mandibular canal wall resorption (Chi-square:16.52 , P<0.01) was found highly statistically significant difference between the patient and control groups ,resorption detected mainly in right side of male patients .Panoramic radiographs showed decreasing in values of the measuring parametersin patients receiving dialysis treatment due to chronic renal failure compared to the control group.

Introduction:

Chronic renal failure (CRF) affects 10% of the population and several changes occur in the oral cavity associated with CRF. Researchers estimate that up to 90% of patients with CRF will show oral symptoms(1). CRF is associated with alterations in bone and mineral metabolism. Osseous changes owing to CRF may become worse from a combination of various factors such as vitamin D deficiency, hyperparathyroidism, malnutrition, the use of certain drugs or hypogonadism(2,3). Oral manifestations of renal disease are related to renal osteodystrophy (RO), acommon condition which is considered as a dysfunctional mineral homeostasis. These manifestations appear in late stage(2,4,5) .

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Radiographic features of RO in mandible or maxilla are bone demineralization, loss of trabeculation, ground glass appearance, totalor partial loss of lamina dura, abnormalsocket healing, giant cell lesions or browntumors and metastatic calcifications(6,7) .These changes appear most commonlysuperior to the mandibular canal or in molarregion .Generalized rarefaction is secondary to osteoporosis. Malocclusion due to too thmobility and collapsed tempromandibular structures can be seen(8) . Bone loss is present but there is no apparent periodontal pocket formation. In areas such as floor of theantrum, lamina dura and angle of themandible, the compact bone becomes thin. It has been proposed that decreased thickness of mandibular angle correlates well with the degree of RO(9) .Panoramic radiography is useful in showing the effect of CRF on bones such as mandibular cortical bone resorption and changes in the trabecular

bone patternyielding a ground glass appearance[10] .The aim of the study to make comparative evaluation of gonial cortical bone thickness, antegonial index, gonial angle valuesand mandibular canal bone resorption, pathologies like ground ‑glass appearance in jawbones and brown tumor in Iraqi patients undergoing dialysis due to chronic renal failure and patients from the healthy control group on panoramic radiographs .

Materials and method:

The study consisted of 20 patients with CRF and 20 healthy controls (15 males and 5 females for each of the patient group and control group). The agewas ranged from35 to55 years for both patient and control groups, 40 individuals in total. The time elapsed sinceentry to dialysis was minimum, 1 year ; maximum, 8years). The panoramic radiographs had been acquired by (My ray CE 0051(V.B1 cocc A 14/C-IMOLA (BO)-Italy, X-ray source (75 kVp, 5 mA) , exposure time (18 sec). The images were examined by radiologist investigators .Gonial cortical bone thickness (The median projection on angulusmandibula bisector of the angle from the parts formed tangents to rear edge of the ramus and to lower edge of the mandible on the orthopantomography Figure 1‑A, antegonial index (The cortical width in the region anterior to the gonion at a point identified by extending a line of “best fit” on the anterior border of the ascending ramus, down to the lower border of the mandible) , Figure 1‑C, and gonial angle (The measurement site in the radiograph was determined to be a point on the mandibular border at the intersection of a line tangential to the most inferior points at the mandibular angle and the lower border of the mandibular body, and a line tangential to the posterior borders of the ramus and the condyle, Figure 1‑D, measurements were conducted on right and left sides of the mandible separately, and average values were calculated; mandibular canal wall resorption, Figure 1‑B [11], was separately examined on the right and left sides of the mandible; the ground‑glass appearance and brown tumor were checked both in maxillary and mandibular bone. The statistical analyses were assessed with the Student’s *t*‑test according to the heterogeneity of the variances, mandibular canal wall resorption with the Chi‑square test, and pathologies such as ground‑glass appearance and Brown tumor as “available” or “not available.”

Results:

Means and SD of antegonial index values , gonial cortical bone thickness values and gonial angle values of the dialysis and control group individuals are given in Table 1, Figure 2.There were high statistically significant differences betweenthe antegonial index (t-test : 6.966, P<0.01) values ofdialysis patients and the control group. Similarly, statistically significant differences were observed between the two groups in terms of gonial cortical bonethickness (t-test: 9.419 , P<0.01) and gonial angle (t-test : 4.965,P<0.01) values. Table 2 ; Figure 3 were explained significant differences between male and female for both dialysis patients and the control group in values of antegonial index, T-test and p-value for two groups respectively (t-test :19.122 , P<0.01; t-test: 3.419 , P-value=<0.027**)**. There was statistically important differences between male and female in gonial cortical thickness values of dialysis group (t-test :5.367, p-value=0.006 **)** while non-significant in control group (t-test: 1.134, p-value=0.32) . The result were observed statistically significant difference between gender of control group in gonial angle values (t-test: 4.185, p-value=0.014), however non-significant in dialysis group (t-test: 1.442, p-value=0.223) . Mandibular canal wall resorption (Chi-square: 16.52, P<0.01) was found highly statistically significant difference between the patient and control groups, resorption detected mainly in right side of male patients. Table 3; Figure 4 are cleared that. No pathologies with ground‑glass appearance and Brown tumor were encountered in groups.

Discussion:

Chronic renal disease (CRD), a progressive and irreversible decline in renal function, is the renal disease with the most implications in dentistry, so this paper is focused on this pathology. Kidneys have the following functions: filtering waste metabolic products, preservation of the electrolytic composition and the volume of the extracellular liquid, regulation of the acid-base balance and endocrine function (synthesis of prostaglandins, erythropoietin, rennin, vitamin D,- involved in bone metabolism- and others)[2,12] Hyperparathyroidism (HPT) is divided into two subgroups as primary and secondary. Secondary HPT is especially seen in patients with advanced renal failure.[10] In these patients, bone resorptions, Brown tumors, fractures and skeletal deformities are the basic (main) clinicalfindings considerably influencing the life quality andlifetimes of the affected patients [13,14] .

The mandibular molar area was the best region for investigation of radiographic changes on panoramic radiograph, because of no superimposition of anatomic structures and more involvement of this area by osseous pathosis. Therefore, the three major changes including lamina dura, trabecular pattern and density changes were much more evident in the molar region, above the mandibular canal on panoramic image [4,15], Only premenopausal female was included in this study to prevent the effect of the hormonal changes in the menopausal period on the bone metabolism. In the present study no brown tumor was found, which was similar to Rani's study [15] and Dagistan et al. [11] study. Queiroz et al. [16] also reported the brown tumor only in one of 154 hemodialysis patients.

Mandibular canal is mostly seen as radiolucency line that has a uniform width and borders as it surrounded by radiopaque walls[17] . Vertical localization and status of the canal can be determined in panoramicradiographs[18] . In this study, mandibular canal wall resorption was encountered in28 of 40 canals that belonged to 20 patients, which is in agreement with study done by Dagistan et al[11] . who found mandibular canal wall resorption in 64 of 80 canals that belonged to 40 patients, and higher values were found compared to the present studies. There were mandibular canal wall resorptions in hemodialysis patients found in a study done by Gavaldáet al[19].

In the study conductedby Kelly et al. [20], mandibular canal wall resorption was observed only in one of 38 patients also Kim and Park[21], observed acomplete or partial loss on the mandibular canal wallsof 8 patients in their study including 31 secondary HPT patients, who underwent dialysis , and lower values were showed compared to the this study which found 28 canals in 20 dialysis patients and they were mainly in right side of male patients , also 2 canals in 20 control patients which in similarity with the result of previous study which found 64 canals in 40 dialysis patients .

In present study, a significant difference was found between dialysis patients and the control group in terms of antegonial index values which is in close proximity with study of Dagistanet al.[11] . The result of this study is in conformity with Raiet al.[22] which observed the same with astudy including 26 HPT patients and a healthy control group found a statistically significant difference between the antegonial index values . The opposite was reported by Ça˘glayan et al.[23] who concluded that there were no statistically significant differences in the AI values in patients with CRF and the control group during thier study was to evaluate the osseous changes of the jaws of patients with chronic renal failure by CBCT obtained from 15 patients with CRF and 15 control patients(7 males and 8 females), the mean was calculated for the antegonial index (AI),this difference may be explained by using CBCT instead of panoramic.

Resorption of the bone at the posterior or inferior border of the mandibular angleregion, the area of the masseter muscle insertion, leads to increasing obtuseness of the mandibular angle[24]. There was an important difference between the gonial angle values of the

patient and control groups in present study which proximated with finding of previous study [11].

Mandibular gonial angle measurements of the patients with chronic renal failure., which had groups separated between the ages of 5 and 16 and was conducted through comparisons between 23 patients with chronic renalfailure and control group, a decrease was observedin the gonial angle values in the 5–14 aged patient group and an increase in the gonial angle values of the14–16 aged patient group through a study done by Al‐Thomali and El‐Bialy [25] .Difference in the gonial angle of the two sexes has been found in this study in two groups and the previous studies, and the general trend was that the gonial angles in males are greater than those measured in females[26] . Usually the mean angle is 3–5° greater in males[27]. This is consistent with the knowledge that males generally have a larger mandible than females. Findings concerning gender differences may also be explained by the fact that, on average, men have greater masticatory force than women [28]. In the patient group, the gonial cortical bone thickness was thinner which it may have caused this difference .Gonial cortical bone thickness <1 mm was interpretedas the radiographic indication of metabolic bonediseases[13,29] .

The gonial corticalbone was thinner in hemodialysis patients stated by Gavaldáet al[19] .in their study . Gonial corticalbone thickness was found thinner than that of healthy in dividuals in a study made on a 40patient group with chronic renal failure [11]. In this study, the gonial cortical bone thickness was thinnerin patients with renal failure compared to the control group, and it corresponded to the present studies. The result of this study were close to those recorded by Bathla et al.[30] that female gonial cortical thickness values were lower than males in majority of the age groups, sexual dimorphism was also recorded as the difference between the mean gonial cortical thickness values of males and females during a study of 60 adult human orthopantomographs were evaluated and divided into six age groups (35-65 years) with equal number of males and females.

Brown tumor isencountered in women 3 times more often than men[1] .No Browntumors were seen in the previous study [15], which corresponded with the reports of [11,29]and this study. Shakibaeiet al.[31] could not determine Brown tumorsin studies they conducted on 74 patients withrenal failure .In another study, the brown tumor development was seen only inone patient in the study, which was conducted byQueirozet al.[16] on 174 hemodialysis patients . In this study, no Brown tumors or similar pathologies were observed in patients and control groups. This situationmay have arisen from the only five female in the sample we chose.

No lesions with ground‐glass appearance were encountered in this study conducted on patient group including 20 patients with dialysis which in similarity with studies of Henriqueset al[32] and Padburyetal. [33]. Bras et al. [10], did not discover any pathology with a ground‐glass appearance in their study that included 12patientwith chronic renal failure. In a study that included 40 patients with chronic renal failure, ground‐glass appearance was not encountered only in one patient, but not seen in the control group[11] .

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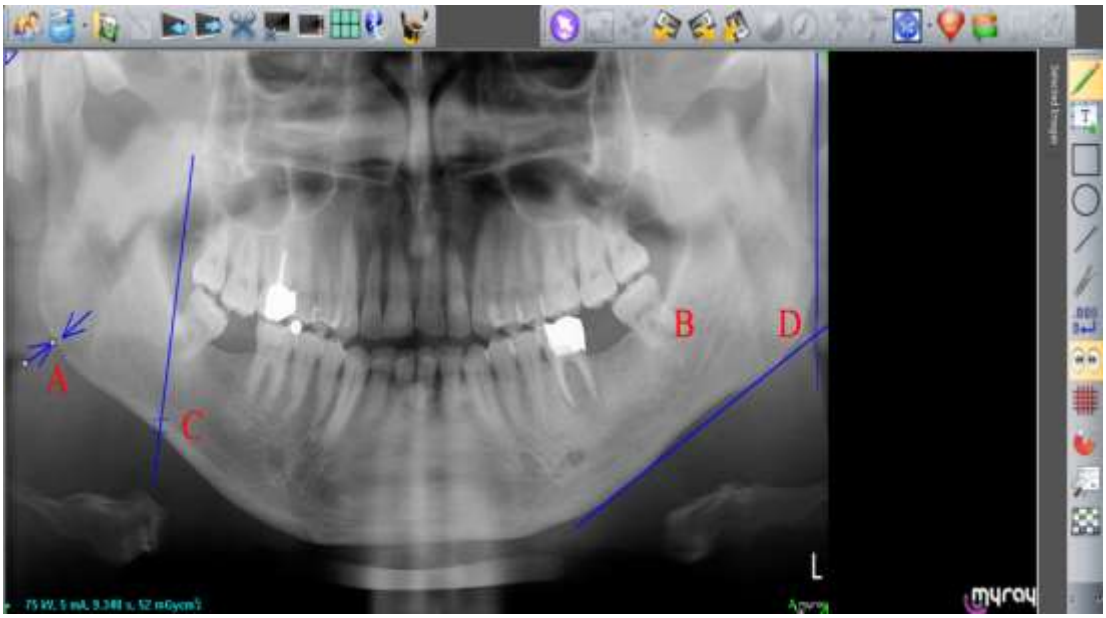

Fig. 1: A - Gonial cortical bone thickness. The median projection on angulusmandibula bisector of the angle from the parts formed; B - mandibular canal wall resorption on the orthopantomography;C - antegonial index. The cortical width in the region anterior to the gonion at a point identified by extending a line of "best fit" on the anterior border of the ascending ramus, down to the lower border of the mandible; D - gonial angle measurement. The measurement site in the radiograph was determined to be a point on the mandibular border at the intersection of a line tangential to the most inferior points at themandibular angle and the lower border of the mandibular body, anda line tangential to the posterior borders of the ramus and the condyle.

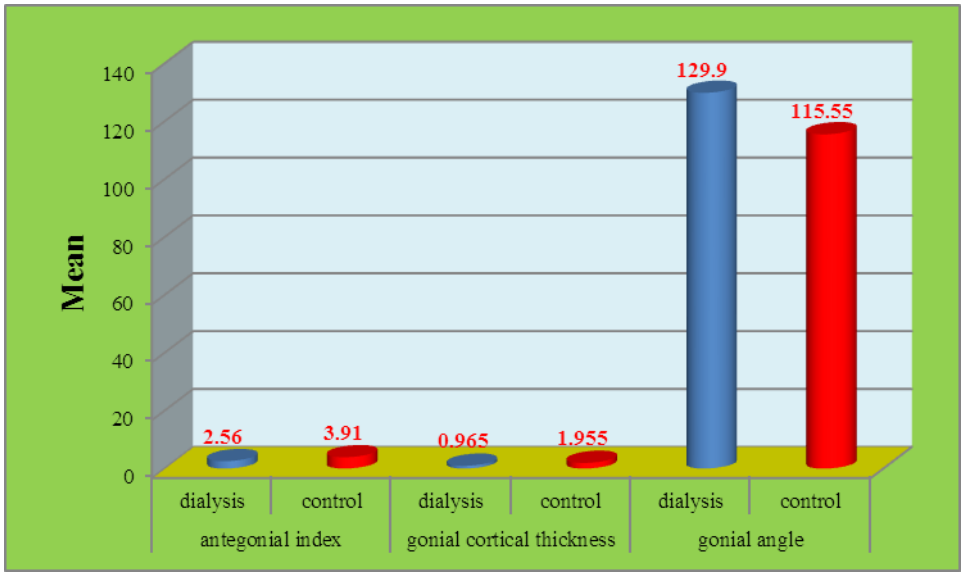

Fig. 2: Show mean of antegonial, gonial cortical thickness and gonial angle between dialysis and control groups.

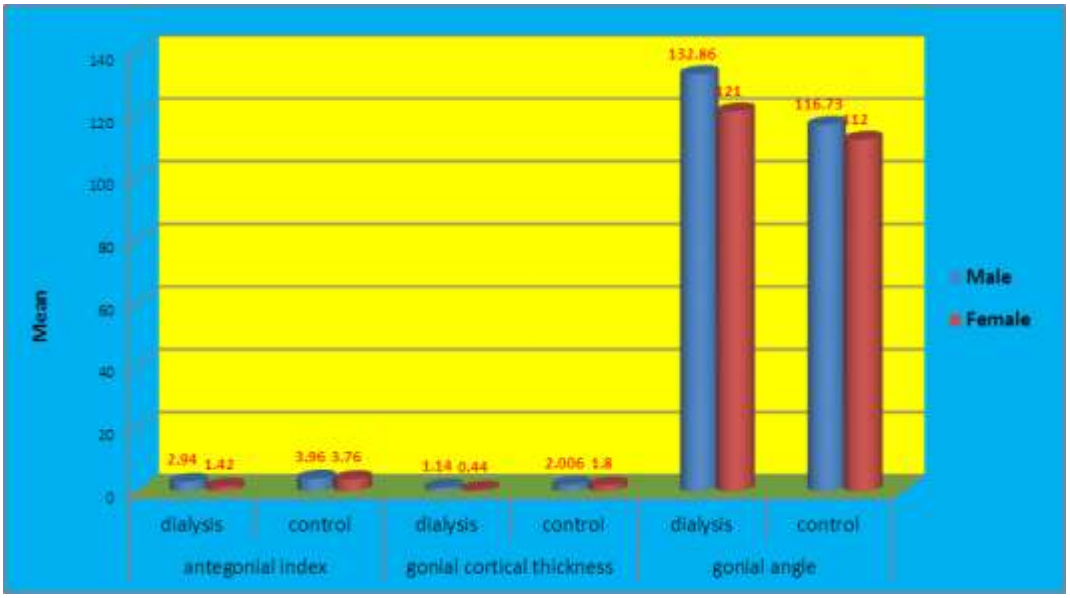

Fig. 3: Show mean of antegonial, gonial cortical thickness and gonial angle between female and male.

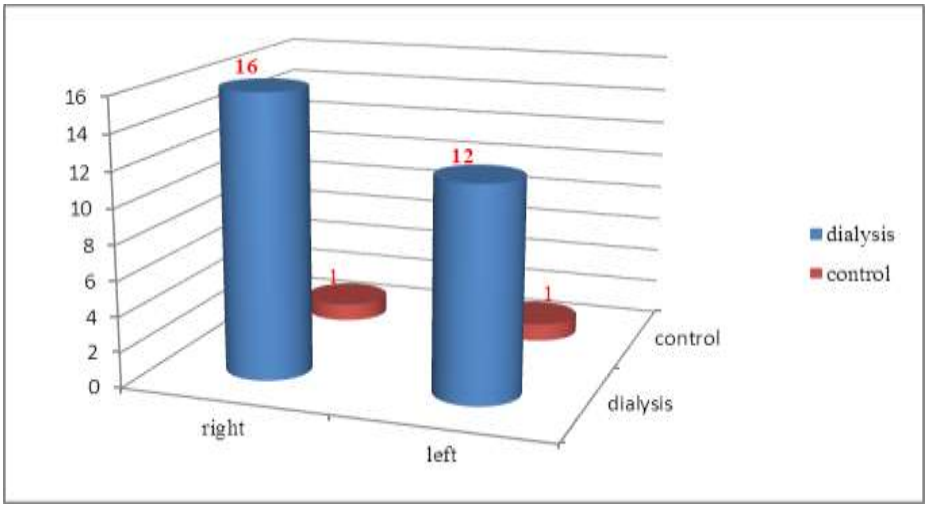

Fig. 4: Mandibular canal bone resorption between left and right in dialysis and control groups .

Table (1): Descriptive and T-test of antegonial, gonial cortical thickness and gonial angle between dialysis and control groups.

Statistic	antegonial index		gonial cortical thickness		gonial angle	
	dialysis	control	dialysis	control	dialysis	control
Mean	**2.56**	**3.91**	**0.965**	**1.955**	**129.9**	**115.55**
SD	**1.173**	**0.668**	**0.493**	**0.374**	**9.233**	**7.366**
t-test	6.966		9.419		4.965	
P-value	P<0.01		P<0.01		P<0.01	
Sig	HS		HS		HS	

*P<0.01 High significant

Table (2): Descriptive and T-test of antegonial, gonial cortical thickness and gonial angle between female and male.

Gender	Statistic	antegonial index		gonial cortical thickness		gonial angle	
		dialysis	control	dialysis	control	dialysis	control
Male	Mean	**2.94**	**3.96**	**1.14**	**2.006**	**132.86**	**116.73**
	SD	**1.111**	**0.767**	**0.445**	**0.419**	**8.296**	**7.941**
Female	Mean	**1.42**	**3.76**	**0.44**	**1.8**	**121**	**112**
	SD	**0.216**	**0.151**	**0.054**	**0.1**	**5.656**	**4**
	t-test	19.122	3.419	5.367	1.134	1.442	4.185
	P-value	P<0.01	0.027	0.006	0.32	0.223	0.014
	Sig	HS	S	S	NS	NS	S

Table (3): Mandibular canal bone resorptionbetween right and left in dialysis and control groups for male and female

	number	right	gender		left	gender		total	percentage	Chi-square	P-value
dialysis	40	16	Male	14	12	Male	10	28	70	16.52	P<0.01 HS
			Female	2		Female	2				
control	40	1	Male	1	1	Male		2	5		
			female			female	**1**				

*P<0.01 High significant

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