Examination of The Mandibular Cortex of Renal Osteodystrophy Patients on Panoramic Radiographies

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Abstract

Aim Renal osteodystrophy, also known as uremic osteopathy, is a constellation of musculoskeletal abnormalities that occur in patients with chronic renal failure. Osteomalacia, Rickets, abnormal calcium and phosphate metabolism due to secondary hyperparathroidism are also related to this phenomenon. Bone changes are expected in renal osteodystrophy cases such as lamina dura loss, resorption of alveolar bone, multiple tiny radiolucencies on calvaria, subperiosteal resorption of bones and osteopenia.

Material and method In the first part of the study, cases who applied to the oral diagnosis and radiology department of our faculty with no known metabolic bone disease were evaluated. These cases were first divided into two separate groups according to gender, and each group was divided into seven different age groups. Age groups were determined as 0-14, 25-19, 20,-29, 30-39, 40-49, 50-59, and over 60 years of age.

Results In the statistical study, it was first investigated whether there was a significant difference between the age groups of both sexes. As a result of the research conducted with one-way analysis of variance, no statistically significant relationship was found between age groups in both genders. Furthermore, the values obtained from both sexes were checked with the t-test and no significant relationship was found.

Conclusion In the light of these findings, it was concluded that our method is a useful method in determining metabolic bone loss.

Keywords Bone, Cortex, Mandible, Osteodystrophy, Renal osteodystrophy

Introduction

A healthy bone structure is under the influence of calcium and phosphorus metabolism, both of which are normally under the influence of many hormones and controlled by vitamin D metabolism (1). With the effect of these hormones, serum calcium level in normal individuals is 8.5 - 10.5 mg/dl. while the serum phosphorus level is 4.7 mg/dl (2). Changes in mineral metabolism may cause hard tissue loss by changing the bone structure. The most common conditions resulting in metabolic bone loss are hyperparathyroidism, osteoporosis after menopause (3-5).

Hyperparathyroidism can be seen primarily and it can also occur secondary to renal failure (6). It is called osteodystrophy (4). In severe kidney failure, vitamin D metabolism is disrupted, which results from reduced calcium absorption in the intestines. It causes phosphorus accumulation and serum phosphorus level increases (1,4). As a result, this condition stimulates parathyroid hormone production. Increased levels of the parathyroid hormone lead to increased osteoclastic activity. The resultant bone resorption produces cortical thinning (subperiosteal resorption) and osteopenia (1). The most well-known radiographic symptoms of metabolic diseases in the mouth are loss of lamina dura (7). However, the lamina dura examination may not always be performed successfully. Reasons for this are poor application of radiography technique, presence of periodontal or periapical lesions and total edentulous jaws. Therefore, in metabolic bone diseases, other criteria should be determined (8). Studies have shown that such cases revealed cortical bone loss especially in the angulus region of the mandible, but this finding has not been sufficiently investigated (9-11).

The aim of this study was to determine the thickness of the cortex on panoramic radiographs in the angulus region of the mandible in healthy individuals without any known metabolic bone disease in order to investigate whether the values obtained vary according to age and gender, and to compare these results with the values obtained from renal osteodystrophy cases as well as to determine whether there is a statistically significant difference between them.

Material and Methods

In the first part of the study, cases who applied to the oral diagnosis and radiology department of our faculty with no known metabolic bone disease were evaluated. These cases were first divided into two separate groups according to gender, and each group was divided into seven different age groups. Age groups were determined as 0-14, 25-19, 20,-29, 30-39, 40-49, 50-59, and over 60 years of age. Since the development of the mandible completes in the first fifteen years of life, the first age range was determined as 0-14 years. In the panoramic radiographs of the cases, the cortex thickness was measured in both the right and left gonion regions with the help of measuring tool on imaging media.

In our research, MicroDicom is used for it is a free viewer software. Mandibular gonial points is assessed because it is more relevant to mandibular cortical thickness. An oblique line were placed between the gonial angle point and end of the cortex. Then, the same procedures were performed on 11 patients, four men

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and seven women, aged between 22 and 38 (average 30 years and 4 months), diagnosed with renal osteodystrophy. In cases where the cortex could not be detected radiographically, the thickness was evaluated as 0. Finally, the obtained values were compared statistically.

Results

The findings obtained from healthy male individuals are shown in Table 1, and the findings obtained from female individuals are shown in Table 2.

Table 1: Healthy Male Cortex Thickness (In mm)

Age Group	Lowest	Highest	Average
0-14	0.75	1.45	1.226
15-19	1.00	1.80	1.226
20-29	1.20	2.55	1.820
30-39	1.15	2.30	1.723
40-49	0.95	2.15	1.546
50-59	1.10	2.55	1.556
Above 60	1.10	2.15	1.450

Table 2: Healthy Female Cortex Thickness (In mm)

Age Group	Lowest	Highest	Average
0-14	0.85	1.85	1.236
15-19	0.95	1.50	1.130
20-29	0.95	2.75	1.606
30-39	1.35	2.50	1.766
40-49	1.10	1.65	1.356
50-59	0.95	1.95	1.310
Above 60	0.90	1.85	1.316

In the statistical study, it was first investigated whether there was a significant difference between the age groups of both sexes. As a result of the research conducted with one-way analysis of variance, no statistically significant relationship was found between age groups in both genders. Furthermore, the values obtained from both sexes were checked with the t-test and no significant relationship was found. Then, individuals with renal osteodystrophy were compared with healthy individuals. Findings related to the renal osteodystrophy patient group are described in Table 3. These values were compared with healthy individuals. In the analysis made with the t-test, the difference was found to be statistically highly significant.

Discussion

Postnatal development of the mandible completes at 10 years old in 65% of individuals, and 10-15 years in the remaining 35%. Therefore, our first age group was determined as 0-14 years old.

Since the risk of postmenopausal osteoporosis is taken into account, especially in female patients over 55 years of age, female patients at this age were selected among those using postmenopausal calcium preparations (3).

Table 3: Findings of patients with renal osteodystrophy

Age	Gender	Dialysis Time	Cortex Thichness (mm)
22	F	20 months	0.05
24	F	8 months	0.00
32	F	11 months	0.00
38	F	6 months	0.75
36	M	4 months	0.00
37	F	6 months	0.05
35	M	12 months	0.10
28	F	11 months	0.15
26	M	9 months	0.00
32	F	6 months	0.00

There are studies in the literature about the oral manifestations of renal osteodystrophy. In the radiographs of such cases, radiolucency increased due to mineral loss in the bone. Cortical bone image disappeared in most of them, and a marked thinning occurred in cortices with a noticeable thickness compared to healthy individuals (12). In our study, we also experienced loss of cortical bone appearance on our radiographs or lack of presence of any cortex, just as other researchers have found (7).

To have a distinct idea regarding how dialysis time and cortical thickness relate to each other, an increased number of individuals with renal osteodystrophy is required. Data size of our patients are limited in this manner. Therefore, no correlation or suggestions were made on this issue. There is no significant loss in the lamina dura of the patients. Silverman et al. also reported that loss of lamina dura was a later symptom and was seen in 11% of patients (13).

In these patients, the degree of renal osteodystrophy can be determined by performing iliac bone biopsy. However, such an attempt was not made in our cases. In the light of these findings, it was concluded that our method is a useful method in determining metabolic bone loss. A further investigation can be made by using more advanced imaging techniques such as CBCT or MRI (14).

Conclusion

A panoramic radiography is cheap, easy to use and can give an idea about the patients' situation with a simple measuring tool. Bone loss due to metabolic bone disease - renal osteodystrophy - can be detected by dental radiographs. In particular, the information that can be obtained from the measurements made from the mandible gonion point was found to be important.

Declarations

Author Contributions: *Conception/Design of Study- M.M.A., M.M.; Data Acquisition- M.M.; Data Analysis/Interpretation- M.M.A.; Drafting Manuscript- M.M.; Critical Revision of Manuscript- M.M.A.; Final Approval and Accountability- M.M.; Material and Technical Support- M.M.; Supervision- M.M.A.*

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