Annals Journal of Dental and Medical Assisting
2022, Volume 2, Page No: 35-38

Available online at: www.tsdp.net

TSDP
Turkish Specialized Dental Publication

Original Article

Investigating the Accuracy of Digital Panoramic Radiographs in Osteoporosis Screening

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Received: 20 August 2022; **Revised:** 29 October 2022; **Accepted:** 10 November 2022

ABSTRACT

As a condition, osteoporosis is characterized by reduced bone density, excruciating pain, and a high risk of fractures. Research conducted worldwide has shown that there is a strong correlation between the onset of osteoporosis and bone density, which may be determined by 2D radiographs from the mandibular bone analysis. Therefore, dental radiographs may help identify individuals at risk of developing osteoporosis or early diagnosis of osteoporosis. The objectives of this study are to determine the osteoporosis risk group, to confirm the diagnostic efficacy of digital panoramic radiographs in predicting osteoporosis using the mandibular cortical index (MCI), and to investigate the effects of age and gender in medically healthy patients. The findings between the MCI indicators and gender are of statistical significance. In our study, we found that men were at higher risk of osteoporosis than women. However, the different age criteria examined in this study did not show any statistical association. Unlike many other studies, our studies found a statistically significant association between males and the likelihood of developing osteoporosis. The most common MCI criterion among the Saudi subgroup was C2. The results may have been influenced by local environmental conditions including a reduction in radiation exposure. Larger models will also be Larger as part of the research expansion to confirm the role of gender in osteoporosis.

Keywords: Digital OPG, Osteoporosis, Dental students, Diagnostic efficiency

How to Cite This Article: Triantafyllopoulos G, Mitsea A, Rontogianni A, Korres D. Investigating the Accuracy of Digital Panoramic Radiographs in Osteoporosis Screening. Ann J Dent Med Assist. 2022;2:35-8.

Introduction

Defective bone remodeling brought on by either diminished bone formation, accelerated bone resorption, or a combination of the two is the hallmark of osteoporosis, a silent bone disease [1, 2]. As a result, bone mineral density decreases, fracture vulnerability increases and bone microarchitecture is compromised, resulting in porous bone [3]. Edentulousness, alveolar bone resorption leading to decreased bone level, mandibular cortex shrinkage, inferior alveolar canals, a decline in the cortical outlines of the maxillary sinus, and abnormalities of the TMJ, including leveling of the condyles, the development of osteophytes, cortical erosion, and internal impairment of the TMJ, are some of the impact of osteoporosis in the maxillofacial region [4].

Every day, when a patient visits the dentist, the dentist uses panoramic radiographs to check for dental issues and concerns. Patients at risk for osteoporosis can be screened using these radiographs. Therefore, Dual-energy X-ray absorptiometry (DXA) and/or biochemical markers can be used to confirm the high-risk category [3].

Mental index (MI), antegonial index (AI), mandibular cortical index (MCI), and panoramic mandibular index (PMI) are methods for evaluating radiomorphometric indices [3-5].

The objectives of this study are to determine the osteoporosis risk group, to confirm the diagnostic efficacy of digital panoramic radiographs in predicting osteoporosis using the mandibular cortical index (MCI), and to investigate the effects of age and gender in medically healthy patients.

Materials and Methods

Materials

After the study protocol was approved by the institutional ethical review board, a total random sample of 250 subjects with ages ranging between 18 to 68 years, were advised to take an orthopantomography (OPG) for dental diagnostic and treatment purposes. Our research has specific criteria that are shown in **Table 1**.

Table 1. Inclusion and exclusion criteria

Exclusion criteria	Inclusion criteria
1. OPG with errors such as OPG positional errors, hyoid bone projected on the mandible compromising diagnostic efficiency 2. Any history of bone pathology and dystrophies 3. Non-traumatic and traumatic fractures 4. A medically compromised condition such as diabetes mellitus 5. Any surgical treatment to the mandible	1. The age range between 18 to 68 years is divided into 5 groups: Group A: 18-28 years of age; Group B: 28- 38 years of age; Group C: 38-48 years of age; Group D: 48-58 years of age; Group E: 58- 68 years of age. 2. Female: Male patients with age and gender-matched samples 3. Absence of conditions mentioned in exclusion criteria

Methods

Calculation of mandibular cortical width indices using an orthopantomography (OPG):

MCI is the classification of the morphological appearance of the mandibular inferior cortex distal to the mental foramen as:

Cl: The endosteal perimeter of the cortex is straight and sharp on both sides of the mandible.

C2: The endosteal margin has crescent-shaped shortcomings (resorption cavities) with cortical remains one to three layers deep on one or both sides.

C3: The endosteal margin comprises thick cortical deposits and is porous [6].

Statistical analysis

Version 22 of the Statistical Package for Social Sciences (SPSS) was utilized for data analysis and findings development.

The Chi-square test and descriptive analysis have been employed to look into a meaningful correlation between age and gender and the various mandibular cortex index groups.

Results and Discussion

Table 2, which displays the male-to-female ratio of 50% each, demonstrates descriptive analysis. 20% of the age groups were distributed equally. According to the MCI classification, 22% of the patients fell into the C1 category, 69.2% into the C2 category, and 8.8% into the C3 category.

Table 2. Descriptive statistics of the study variables

Variables	Frequencies
Gender	Males: n = 125 (50%) Females: n = 125 (50%)
Age groups	18-28 years: n = 50 (20%) 29-38 years: n = 50 (20%) 39-48 years: n = 50 (20%) 49-58 years: n = 50 (20%) 59-68 years: n = 50 (20%)
MCI classification	C1: n = 55 (22%) C2: n = 173 (69.2%) C3: n = 22 (8.8%)

To find any significant correlation between age and gender and the various mandibular cortex index groups, a chi-square test was used. With a p-value of.001, **Table 3** demonstrates that there is a statistically significant correlation between gender and MCI. Females were shown to have a higher prevalence of C1 (32%), followed by males (78%), and males (10%). However, **Table 4** P-value of .081 indicates that there is no statistically significant correlation between age and MCI.

Table 3. Association of gender with mandibular cortex index

MCI Classification	Gender	P-value
C1	Male: 12% Female: 32%	.001*
C2	Male: 78% Female: 61%	
C3	Male: 10% Female: 7%	

*Chi-square test resulting in statistically significant association

Table 4. Association of age with mandibular cortex index

MCI classification	Age groups	P-value
C1	18-28 years: 32% 29-38 years: 28% 39-48 years: 20% 49-58 years: 12% 59-68 years: 18%	
C2	18-28 years: 64% 29-38 years: 66% 39-48 years: 76% 49-58 years: 72% 59-68 years: 68%	**.081**
C3	18-28 years: 4% 29-38 years: 6% 39-48 years: 4% 49-58 years: 16% 59-68 years: 14%	

Micro-architectural weakening and reduced bone tissue mass are hallmarks of osteoporosis, a general skeletal condition that increases bone susceptibility and fracture risk. People of various ages and sorts have it [7]. Examining fractures that form in bones with minimal damage due to a decrease in bone mineral density is the first step in the overall diagnosis of osteoporosis. Like the other bones in the body, the jawbones can be affected by medical treatment or a systemic disease, which results in complete tooth loss. One in three women and one in five men over 50 suffer from osteoporosis, which is primarily a condition that mostly affects older women and may go undetected until fracture symptoms appear. Our study's findings show that men are more likely than women to develop osteoporosis, in contrast to earlier research that found a feminine preference for the condition [8].

Early detection and treatment of osteoporosis are essential to reducing the risk. Widely used in dentistry, panoramic radiographs allow for the evaluation and analysis of the upper and lower jaw bone structure in addition to teeth. Finding osteoporosis symptoms in dental panoramic radiographs is essential to the diagnosis of the condition [6].

According to earlier studies, the MCI has the highest reliability and repeatability of any radio-morphometric test. In contrast to our study's results, which showed C1 (55 (22%)), C2 (173 (69.2%)), and C3 (22 (8.8%)), some studies showed incidences of MCI in a sample group of 80 (i.e., the intensity of cortical modification classes from (C1 to C3) values of the patient were: C1 (14 (17.5%)), C2 (53 (66.3%)), and C3 (13 (16.3%)). This indicates that C2 is the most common type to be seen among the populations evaluated, respectively [9, 10].

Limitations of the study

A bigger sample size was not evaluated due to scheduling constraints. Nonetheless, the study's more standardized results—which will be expanded to include bigger groups in subsequent research—will be achieved by equal gender distribution and adherence to STROBE principles.

Conclusion

Unlike most other studies, ours found a statistically significant association between males and the likelihood of developing osteoporosis. The most common MCI criterion among the Saudi subgroup was C2. When utilizing panoramic radiographs to diagnose osteoporosis, age did not appear to have any bearing. Following STROBE standardization requirements, age as a confounding factor will be further examined using bigger samples to assess the study as an extension for additional validation of the findings in the Saudi population.

Acknowledgments: The authors of this study would like to acknowledge the support and cooperation of the research center of Riyadh Elm University.

Conflict of Interest: None

Financial Support: None

Ethics Statement: This study fulfilled all the ethical requirements including data collection and confidentiality of study participants.

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