

Evaluation of Mandibular Cortex for the Assessment of Osteoporosis in Postmenopausal Women Using Panoramic Imaging – A Cross Sectional Study

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Abstract:

Background: Osteoporosis is a skeletal disease associated with postmenopausal or senile states and represents the most common metabolic bone disorder. It generally begins around the fifth decade and characterized by low bone mass and micro-architectural deterioration leading to increase in bone fragility and susceptibility to fracture. Assessment of jawbone quality and mandibular cortical erosion, by dental panoramic radiograph, is expected to be very useful for early detection of osteoporosis in postmenopausal women. The aim of this study was to assess the mandibular cortex in postmenopausal women by panoramic radiograph

Materials and Methods: In the current study, 30 subjects' age ranged from 47-60, in postmenopausal stage without any systemic diseases formed the case group and another 30 subject's age ranged from 25-35 formed the control group. Jaw bone cortical thickness, quality and quantity, assessment was done using panoramic radiograph for each individual. The measurements were repeated twice within a period of ten days.

Results: Cortical thickness (MCW), quality (MCI) and quantity (PMI) of jaw bone estimated on the radiographic images were recorded and assessed statistically. Paired t-test done for comparison of two groups showed no significant difference for MCW, PMI on conventional panoramic radiograph.

Conclusion: Early detection of osteoporosis can be done with the assessment or evaluation of mandibular bone quality, at the lower edge of mandibular cortical bone. Cortical erosion determined on dental images may be considered as a means of identifying postmenopausal women at risk for osteoporosis.

Key Word: Osteoporosis, Panoramic radiography, Postmenopausal women

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I. Introduction

Osteoporosis is a disease characterized by low bone mass and micro-architectural deterioration of bone tissue, leading to bone fragility and enhanced susceptibility to fractures. Osteoporosis is predominantly a condition of the elderly [1, 2, 3, 4]. It affects commonly the post-menopausal women as a result of estrogen withdrawal. A major obstacle to combating osteoporosis is the failure to identify individuals who have osteoporosis until fractures form with little trauma to the bones. Thus, detection of osteoporosis, assessment of bone mass, and identification of fracture risk are important goals when evaluating patients for osteoporosis [5, 6]. Several investigators have stated that osteoporosis results in reduced jaw bone mass and altered mandibular structure, especially of the inferior border. [7, 8, 9].

Dental radiographs, especially panoramic images, have been used to predict low bone mineral density in patients. A number of mandibular cortical indices, including the mandibular cortical width (MCW) and the panoramic index (PMI), the mandibular cortical index (MCI), have been developed to assess and quantify the quality of mandibular bone mass and to observe signs of resorption on panoramic radiographs for identification of osteopenia. Osteopenia can be identified by the thinning of the cortex at the lower border of the mandible. A thin mandibular cortical width has been shown to be correlated with reduced skeletal bone mineral density. The mandibular cortical index describes the porosity of the mandible and is related to the mandibular bone mineral density. Many studies have shown that this index is a useful method of osteoporosis screening [10]. Since the oral cavity and jaws undergo regular radiographic examinations and most elderly individuals have more opportunities to visit a dental clinic than to visit a medical clinic for diagnosis of osteoporosis, it is likely that evaluation of these indices on panoramic radiographs might yield useful information regarding bone mass density [9].

The purpose of this study was to assess the mandibular cortex in postmenopausal women using panoramic imaging in assessing the quality and quantity of jaw bone in postmenopausal women.

Table no 1:Conventional panoramic radiograph (intra-observer comparison)

PARAMETERS	Mean	Std.Dv.	Diff.	SD Diff.	t	p
MCW	5.03	1.39	0.15	0.95	1.00	0.3235
	4.88	0.99				
PMI	2.84	16.08	2.54	16.08	1.00	0.3232
	0.30	0.07				

Table no2:Conventional panoramic radiograph (inter-observer comparison)

PARAMETERS	Mean	Std.Dv.	Diff.	SD Diff.	t	p
MCW	5.03	1.39	-0.55	1.22	-2.85	0.0069
	5.58	0.84				
PMI	2.84	16.08	2.49	16.07	0.98	0.3331
	0.35	0.08				

Table no3 :Comparison of Case and Control

METHOD	PARAMETERS	Control		Cases		t-value	p
		Mean	Std.Dev.	Mean	Std.Dev.		
Conventional	MCW	5.85	0.93	5.30	0.66	2.16	0.0776
	PMI	0.36	0.10	0.35	0.05	0.60	0.5549

Table no 4:Conventional panoramic radiograph (MCI)

PARAMETER (MCI)	C1	C2	C3	Kappa Coefficient
Intra observer reliability	24	30	6	0.5591
Inter observer reliability	25	27	8	0.5317

Kruskal Wallis ANOVA test H = 20.83

IV. Discussion

Bone mass decreases with age and the rate of bone loss in the initial 10 post-menopausal years vary widely. Bone loss ranges from less than 1% to more than 5% per year for cancellous bone and from 0.5 to 2% for cortical bone. The earliest suggestion of an association between osteoporosis and oral bone loss was made in 1960. The mandible seems to undergo a decrease in mineralized bone throughout life, as with other bones. Hildeboltin a recent review of the literature stated that there exists association between osteoporosis and oral bone loss and mandibular morphology^[14].

Mandibular cortical width (MCW) and Panoramic mandibular index (PMI) used in this study to measure the cortical bone mass. In our study the mean MCW, PMI, MCI values of post-menopausal women was less than that of the pre-menopausal women, thus displaying the fact that bone mass in post-menopausal women is less when compared to pre-menopausal women. MCI appearance was related to the menopausal status of the patients suggesting that onset of menopause leads to changes in mandibular cortical morphology. In our study C1 was most common in pre-menopausal group and C3 appearance was seen in post-menopausal group thus reflected age related changes. The present study is in agreement with the results of Knezovic-Zlataric et al, reflecting age related changes^[15].

In our study there was good intra-observer agreement for the measurements of MCI MCW, PMI in conventional panoramic radiograph. The inter-observer comparison showed no significant difference for MCI and PMI thereby revealing that measurement using conventional method is reliable. MCW showed significant difference in conventional panoramic radiograph. The difference may be related to variation in the location of the mental foramen, positioning error and evaluator error.

The comparisons of the mean between the two groups revealed no significant difference for MCI, MCW, PMI measurements in conventional panoramic radiograph. In our study mean values of post-menopausal group were lesser than the pre-menopausal group. In a similar study by Klemettiet al. Panoramic radiographs were found to be accurate for the measurements of MCW, PMI and reported similar mean values in post-menopausal group^[16].

The limitation of our study may be its variations in measurements between observers, which may prove to be a drawback in practical clinical use; however it can be overcome after sufficient expertise and can help the clinician in early screening of patients at high risk of osteoporosis.

V. Conclusion

Panoramic radiography is an imaging technique commonly used by dentists which gives a lot of information and can be used to gain information about bone density. There exists a relationship between the quality of the cortex and the quantitative index of the mandible. When the quality of the cortex is low, the value of the mean cortical width decreases. Mean cortical width, panoramic mandibular index and mean cortical index may be a useful index for the diagnosis of osteoporosis. Practitioners may play a great role in the screening and early diagnosis of osteoporosis by examining cortical bone mass by panoramic imaging.

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