Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 10 Issue 1 Jan-Mar 2024

Original Research

A Radio-Morphometric Analysis of Mandibular Bone Quality in Reproductive & Post Menopausal Women of Central India- A Cross Sectional Study

Anjali Dhawan [1], Shivani Dwivedi [2], Sumit Narang [3], Sudhanshu Chauhan [4], Supriya Bharti [5], Kanishk Soni[6]

[1]Post Graduate Student, Department of Periodontology, Peoples Dental Academy, Bhopal
[2] Professor, Department of Periodontology, Peoples Dental Academy
[3] Head and Professor, Department of Periodontology, Peoples Dental Academy
[4] Post Graduate Student, Department of Periodontology, Peoples Dental Academy
[5] Post Graduate Student, Department of Periodontology, Peoples Dental Academy
[6]Post Graduate Student, Department of Periodontology, Peoples Dental Academy

ARTICLE INFO

Keywords: Osteoporosis, Mandibular Cortical Index, Reproductive, Post Menopausal, Bone Mineral Density

ABSTRACT

Background: Osteoporosis is particularly high in females, the early identification of which remains a challenge. Panoramic radiographs are routinely advised to detect periodontal diseases and can be used to predict low bone mineral density (BMD). Hence, this investigation was aimed to identify the risk of osteoporosis in reproductive and postmenopausal chronic periodontitis women with digital panoramic radiographs.

Materials and Methods: The study population consisted of 70 female patients. The patients were equally allotted to two groups. Group A consisted of 35 systemically healthy pre-menopausal females with chronic periodontitis. Group B consisted of 35 patients systemically healthy post-menopausal females with chronic periodontitis. Digital panoramic radiographs were used to measure Mandibular cortical index (MCI).

Result: Chi square test showed there were significant difference between groups with chi square value 70.00 and p value 0.001.

Conclusion: The positive association between MCI and chronic periodontitis in postmenopausal women confirms the high risk of osteoporosis in them.

Introduction

Osteoporosis is a prominent condition among the most pervasive conditions that debilitate bones and is thus a noteworthy public health issue. Osteoporosis is characterized by fragile, weak bones that are prone to fracture. Unfortunately, it is a silent disease and is often diagnosed only when a minor fall causes wrist or hip fracture (1).

The prevalence of osteoporosis is particularly high in females, owing to the changing hormonal levels regulating metabolic processes in the body. A major challenge in combating this disorder lies in the early diagnosis before the occurrence of clinical consequences.

* Corresponding author*:*
Anjali Dhawan, Post Graduate Student, Department of Periodontology, Peoples Dental Academy ,E-1/6/3 Sector-15 Rohini, Delhi-110089

After menopause, women tend to gradually lose bone mineral density (BMD) with a consequent increased fracture risk (2).

Chronic periodontitis on the other hand is one of the most common inflammatory diseases caused by specific microorganisms, leading to progressive destruction of the connective tissue and alveolar bone (3). Although microbial plaque is considered to be a prerequisite for the initiation and progression of chronic periodontitis, the advanced destruction many a times, it cannot be explained exclusively on the basis of quantitative and/or qualitative analysis of microbial deposits. Reduced bone mass associated with microarchitectural deterioration, as seen in osteoporosis may have a compounding influence on the inflammation-mediated alveolar bone destruction (4).

Since both osteoporosis and periodontal diseases involve bone resorption as a manifestation of expression and both have common risk factors, it has been hypothesized that osteoporosis could be a risk indicator for progression of periodontal disease (5). Given the complexity and multifactorial nature of periodontal disease, certain systemic conditions including osteoporosis may not only predispose an individual to this disease but also lead to a rapid progression of the disease, creating an even more fragile state (6).

Alveolar bone has been used to detect osteoporosis as the cortical height and mineral density seems to follow a similar pattern as seen in the general mineral status of the skeleton. DXA measurements and densitometric analysis of jaw bones were attempted by many clinicians. Again, because of lack of feasibility, an easier alternative was being searched. So, clinicians measured various parameters on the panoramic radiographs of jaw bone in attempt to diagnose osteoporosis as it was highly economical. Radiomorphometric analysis have now become markers for osteoporosis.

The oral cavity and jaws are radiographically

examined more often than any other part of the human body. Panoramic radiograph could be useful as a simple screening method in the diagnosis of osteoporosis and can provide valuable information on the quality of the jaw bone. Osteoporosis can be diagnosed by observing tooth loss, thinning of the mandibular inferior cortex, and changes in the morphology of the endosteal margin of the cortex and of the spongy bone of the jaws (7).

Considering these facts, the present study was aimed to identify the risk of osteoporosis in pre- and postmenopausal chronic periodontitis women by digital panoramic radiographs.

MATERIALS AND METHODS

The study population consisted of 70 female patients visiting the Department of Periodontology and oral Implantology of Peoples Dental Academy, Bhopal. The patients were equally allotted to two groups, with the prescribed inclusion criteria:

Group A consisted of 35 patients in the age range of 40- 64 years of systemically healthy pre-menopausal females with chronic periodontitis.

Group B consisted of 35 patients in the age range of 40- 64 years of systemically healthy post-menopausal females with chronic periodontitis.

Patients of generalised chronic periodontitis, free from systemic diseases affecting BMD, bone lesions, fracture, or deformity or previous mandibular surgery, or women not undergoing hormone replacement therapy or who had not undergone hysterectomy or oophorectomy were included in the study.

Patients on medication, affecting the BMD like Steroids, Anticonvulsants were excluded from the study.

DATA COLLECTION PROCEDURES

Digital panoramic radiograph was obtained for each participant for assessment of the radiomorphometric index which were done with the help of a software Carestream Dental CS 9600, which was done by a single operator. Following index was measured on Dental panoramic radiographs (DPR)

Mandibular Cortical Index (MCI): This is a classification of the appearance of the lower border cortex of the mandible distal to the mental foramina, as viewed on panoramic radiographs as described by Klemetti et al. (8). On a three-point scale

C1: the endosteal margin of the cortex is even and sharp on both sides (fig. 1).

C2: the endosteal margin shows semilunar defects (lacunar resorption) or seems to form endosteal cortical residues (one to three layers) on one or both sides (fig. 2).

C3: the cortical layer forms heavy endosteal residues and is clearly porous (fig. 3).

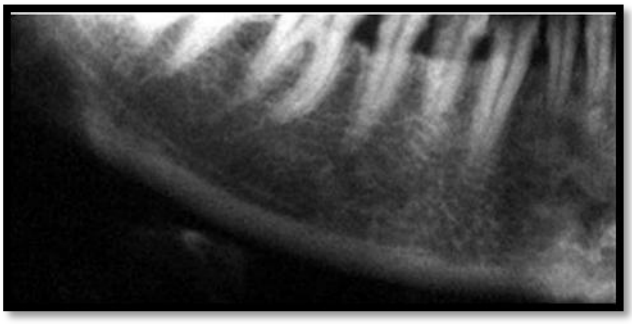


Fig. 1 MCI category C1 – endosteal margin of the cortex is sharp and even on both sides of the mandible

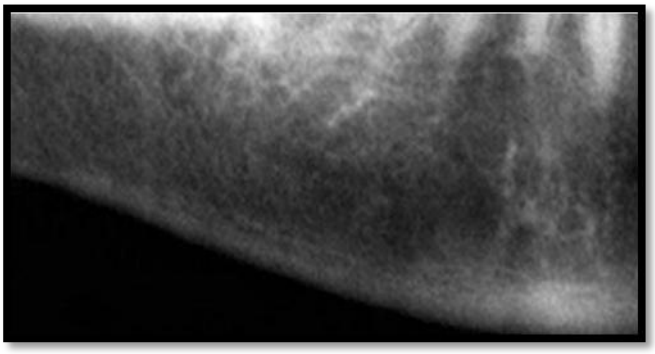


Fig. 2 MCI category C2 – endosteal margin with semilunar defects (resorption cavities) and cortical residues 1–3 layers thick on one or both sides

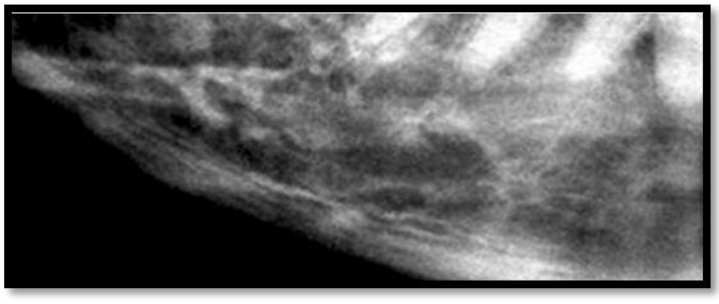


Fig. 3 MCI category C3 – endosteal margin appearing

clearly porous with thick cortical residues

The radiographic evaluations were performed by a single examiner and the readings were noted.

RESULT

The study was conducted to compare the quantity of mandibular bone with the help of morphometric analysis in pre and post-menopausal women having chronic generalized periodontitis undergoing physiological bone changes using dental panoramic radiographs. The study included 70 participants and were divided on the basis of commencement of menopause into two groups.

Group A: pre-menopausal women.

Group B: post-menopausal women.

Mandibular cortical index (MCI)

The Group A included 37 participants while the Group B had 33 participants. The Mandibular cortical index (MCI) was compared between the groups. All the participants in Group A belongs to C1 while in Group B 30 participants belong to C2 category while 3 patients belong to C3 category. Chi square test showed there were significant difference between groups with chi square value 70.00 and p value 0.001. (Table 1)

Graph 1 showed comparison of MCI index between groups. All the participants in Group A belongs to C1 while in Group B 30 participants belong to C2 category while 3 patients belong to C3 category.

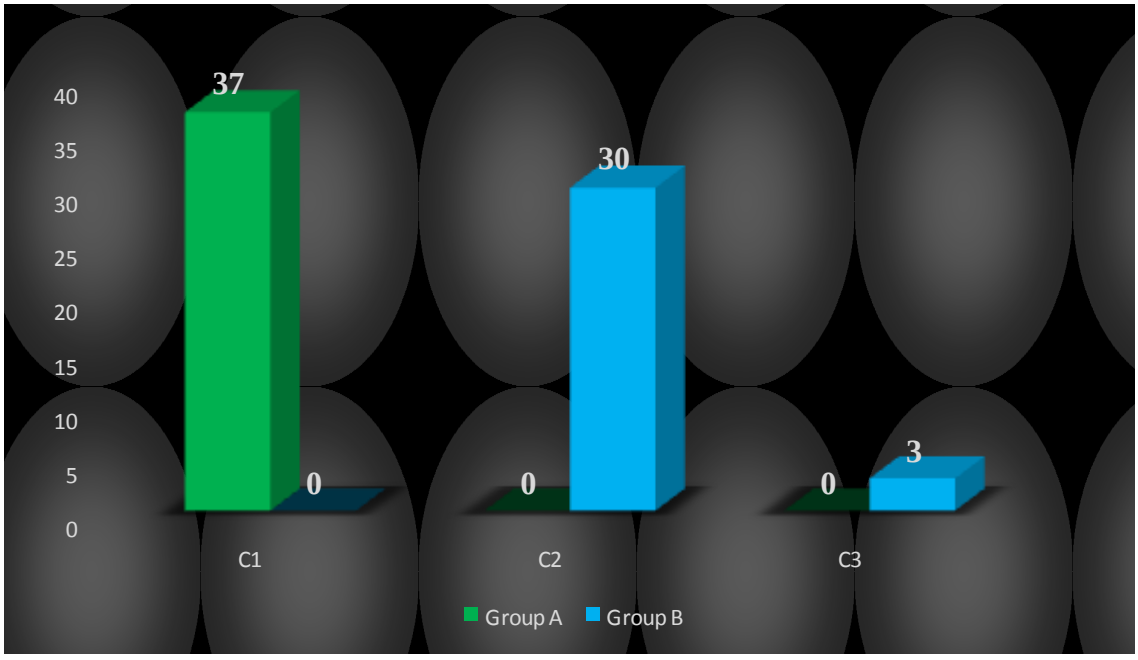
DISCUSSION

Menopause in women usually leads to decrease in BMD which eventually becomes a risk factor of periodontitis. Decline in bone mass is accelerated in women after menopause and the rate of bone loss has been reported to vary from 0.5 to 1% per year. Thus, menopause puts women at greater risk of osteoporosis. The bone mineral density (BMD) of mandible is shown to be affected by mineral status of the skeleton and also by general diseases that

Table 1: Comparison of MCI index between Groups

Group	*MCI*			*Chi square value*	*P value*
	C1	*C2*	*C3*		
A	*37*	*0*	*0*	*70.00*	*0.001***
B	*0*	*30*	*3*		
Total	*37*	*30*	*3*		

Graph 1: Comparison of MCI between Groups



causes generalized bone loss. Various studies have reported that decreased BMD affects the morphometric, densitometric and architectural properties of mandibular bone (9).

In our study, mandible site was chosen as, Horner et al, in a study reported mandibular body to be most appropriate site for any planned assessment of validity of mandibular measurements as a predictor of general bone mass.

Although bone densitometry is accepted as the gold standard in diagnosis of osteoporosis and a large number of methods for assessment of bone loss have been proposed (dual photon absorptiometry (DPA), dual energy X-ray absorptiometry (DXA), single photon absorptiometry (SPA), quantitative computed tomography (QCT), one of the simplest method in the dental evaluation of mandibular bone loss is dental panoramic radiograph (DPR).

Radiographic bone density can be assessed from simple radiographs in two main ways: by taking linear measurements (morpho -metric analysis) or by measuring optical density of bone and comparing it with a reference step wedge (densitometric analysis). Morphometric analysis has been limited to cortical thickness measurements at various sites and calculation of the panoramic mandibular index (9).

Additionally, Mashalkar et al. suggest a statistically significant correlation between periodontitis and bone mineral density (BMD) ($p=0.045$) in postmenopausal women (10). Patients with osteoporosis primarily exhibit a marked decrease in BMD and related quality of life impacting conditions such as periodontal disease (11).

Klemetti et al. suggested that a thin and/or abraded inferior cortex of the mandible is an indicator of alterations in the alveolar bone and is useful in identifying undetected low skeletal BMD or osteoporosis in postmenopausal women (12).

In our study, MCI appearance was related to

the menopausal status of the patients suggesting that onset of menopause leads to changes in mandibular cortical morphology. C1 was most common in pre-menopausal group. Individuals with C2 and C3 appearance was seen in post-menopausal group. Chi square test showed there were significant difference between groups with chi square value 70.00 and p value 0.001. (Table 1)

We observed a relatively high frequency of moderately eroded cortex on orthopantomograms (OPGs) of women aged between 50 years and 60 years.

This finding is in agreement with the study performed by Dagistan and Bilge who investigated and found an association between MCI and osteoporosis. (13)

Our study is in accordance with the study of Akshita D et al. The study showed that, MCI was reliable in identifying postmenopausal women with low bone mineral density (BMD) (P = 0.01). MCI had high diagnostic accuracy (93%) in identifying postmenopausal women with low BMDs (14). Study conducted by Kolte RA (4) showed a greater prevalence of C2 and C3 patterns among postmenopausal women. MCI correlation with MI ($P < 0.0001$), PMI ($P < 0.0001$) and age ($P = 0.0029$) indicated a highly significant variance.

On the contrary, studies done by Jowitt et al. (15) and Drozdwaska et al. (16) did not show an association between MCI and BMD condition. As MCI is an objective index, there could be several reasons attributed to the varied results.

The greater percentage of C2 and C3 pattern of the mandibular cortex observed in postmenopausal chronic periodontitis patients is a pointer toward an unknown influence in the resorption of alveolar bone which most likely is due to the systemic impact.

CONCLUSION

Our results suggest that MCI has a good reliability and diagnostic accuracy in identifying patients with low BMD. Women

with pronounced thinning or resorption of inferior mandibular cortices; C3 category should be referred for further osteoporosis investigation. Women under C2 category, corresponding to osteopenia must undergo periodic check-ups and an appropriate treatment must be rendered to prevent the risk of osteoporosis. Furthermore, it must be emphasized that an increased percentage of patients with undetected decrease in BMD may be identified by screening with digital panoramic radiographs which are done on a routine basis for periodontal and other dental diseases and thus could be used as an effective aid to quantify bone density in future.

REFERENCES

1. Horner K, Devlin H. The relationship between mandibular bone mineral density and panoramic radiographic measurements. Journal of dentistry. 1998 May 1;26(4):337-43.
2. Gulsahi A, Yuzugullu B, Imirzalıoglu P, Genc YA. Assessment of panoramic radiomorphometric indices in Turkish patients of different age groups, gender and dental status. Dentomaxillofacial radiology. 2008 Jul;37(5):288-92.
3. Brown LJ, Löe H. Prevalence, extent, severity and progression of periodontal disease. Periodontology 2000. 1993 Jun;2(1):57-71.
4. Kolte RA, Kolte AP, Potey AM. Risk assessment of osteoporosis in pre-and postmenopausal periodontally healthy and chronic periodontitis women with digital panoramic radiographs. Journal of indian society of periodontology. 2017 Nov 1;21(6):461-5.
5. Tezal M, Wactawski- Wende J, Grossi SG, Ho AW, Dunford R, Genco RJ. The relationship between bone mineral density and periodontitis in postmenopausal women. Journal of periodontology. 2000 Sep;71(9):1492-8.

6. Garcia RI, Henshaw MM, Krall EA. Relationship between periodontal disease and systemic health. Periodontology 2000. 2001 Feb;25(1):21-36.
7. Devlin H, Horner K. Diagnosis of osteoporosis in oral health care. Journal of oral rehabilitation. 2008 Feb;35(2):152-7.
8. Klemetti E, Kolmakov S, Kröger H. Pantomography in assessment of the osteoporosis risk group. European Journal of Oral Sciences. 1994 Feb;102(1):68-72.
9. Mudda JA, Bajaj M, Patil VA. A Radiographic comparison of mandibular bone quality in pre- and post-menopausal women in Indian population. J Indian Soc Periodontol. 2010 Apr;14(2):121-5.
10. Mashalkar VN, Suragimath G, Zope SA, Varma SA. A cross-sectional study to assess and correlate osteoporosis and periodontitis among postmenopausal women: a dual energy X-ray absorptiometry study. Journal of mid-life health. 2018 Jan;9(1):2.
11. Prasanna JS, Sumadhura C, Karunakar P. A comparative analysis of pre-and postmenopausal females with periodontitis and its response to a non invasive clinical approach. Journal of Menopausal Medicine. 2017 Dec;23(3):202.
12. Klemetti E, Collin HL, Forss H, Markkanen H, Lassila V. Mineral status of skeleton and advanced periodontal disease. Journal of clinical periodontology. 1994 Mar;21(3):184-8.
13. Dagistan S, Bilge OM. Comparison of antegonial index, mental index, panoramic mandibular index and mandibular cortical index values in the panoramic radiographs of normal males and male patients with osteoporosis.

Dentomaxillofacial Radiology. 2010 Jul;39(5):290-4.

14. Akshita D, Asha V. Reliability of panoramic radiographic indices in identifying osteoporosis among postmenopausal women. Journal of Oral and Maxillofacial Radiology. 2017 May 1;5(2):35-9.
15. Jowitt N, MacFarlane T, Devlin H, Klemetti E, Horner K. The reproducibility of the mandibular cortical index. Dentomaxillofacial Radiology. 1999 May 1;28(3):141-4.
16. Drozdzowska B, Pluskiewicz W, Tarnawska B. Panoramic-based mandibular indices in relation to mandibular bone mineral density and skeletal status assessed by dual energy X-ray absorptiometry and quantitative ultrasound. Dentomaxillofacial Radiology. 2002 Nov;31