RADIOGRAPHIC COMPARISON OF MANDIBULAR BONE QUALITY IN PATIENTS WITH CHRONIC GENERALIZED PERIODONTITIS TO ASSESS OSTEOPOROSIS

Periodontology

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ABSTRACT

Aim and Objectives: The main objective of the study was to assess mandibular bone changes in individuals with chronic generalized periodontitis of different age groups, using radio morphometric indices such as mandibular cortical index (MCI), mental index (MI), and panoramic mandibular index (PMI) in Indian population from dental panoramic radiographs.
Materials and Methods: Panoramic radiographs of 60 patients with chronic generalized periodontitis visiting the Department of Periodontology, Rajarajeswari dental college and hospital, Bangalore were taken and divided into two age groups. Group 1 included patients in the age group of 30-44 years and group 2 with an age range of 45–60 years. All the radiographs were assessed for PMI, MI and MCI and presence of periodontitis.
Results: Slightly higher mean values for PMI were observed in group 1 than group 2 whereas MI showed greater value in group 2. However, the differences in both groups were not statistically significant. MCI when compared between groups, C2 and C3 values were higher in group 2 suggestive of higher risk for osteoporosis with advancing age.
Conclusions: Radio morphometric indices could be used by general dentists to detect patients at higher risk of osteoporosis.

KEYWORDS

osteoporosis, Indices, Periodontitis, Bone mineral density

INTRODUCTION

Periodontitis (PD) a chronic infection-mediated condition modulated by different genetic and environmental factors, characterized, in advanced forms, by loss of the soft tissue attachment to teeth and resorption of alveolar bone. Although bacteria are a necessary factor in the equation, the reaction of the host's immuno-inflammatory system is responsible for most of the destruction found in periodontal disease.[1] Recently, it has been suggested that estrogen deficiency affects systemically the sequence of bone resorption and formation and has received increasing attention in relation to the stability of alveolar bone structure in postmenopausal women. Some studies have reported an association between osteoporosis and bone loss in periodontal diseases. Also, there are evidences that support some of the periodontitis risk factors including age and osteoporosis.

Osteoporosis (OP) is a systemic skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissue, with a consequent increase in fragility and susceptibility to fracture of bones. OP may also affect the jawbones, whose structure may be impaired by other conditions resulting in bone loss. It might be expected that the alveolar bone destruction seen in periodontitis could be magnified in the presence of generalized skeletal disturbances such as OP. Nonetheless, it is increasingly becoming evident that PD may have several systemic implications (e.g. increased risk for cardiovascular disease), and hypothetical models exist linking OP and PD.[2] Since both osteoporosis and periodontal diseases are bone destructive diseases, it has been hypothesized that osteoporosis could be one of the risk factors for the progression of periodontal disease.

The bone mineral density (BMD) of mandible is shown to be affected by mineral status of the skeleton and also by general diseases that causes generalized bone loss. Various studies have reported that decreased BMD affects the morphometric, densitometric and architectural properties of mandibular bone. 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.[3] 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 evaluation of mandibular bone loss is by 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).[4] Morphometric analysis has been limited to cortical thickness measurements at various sites and calculation of the panoramic mandibular index. Previous studies have reported significant correlations between mandibular BMD measurement by DXA method and mandibular cortical thickness or panoramic mandibular index.

Hence, the aim of the study was to assess age related mandibular bone changes in patients with chronic generalized periodontitis of different age groups using different radio morphometric indices like mandibulocortical index(MCI), mental index(MI) and panoramic mandibular index(PMI).

MATERIALS AND METHODS

A total of 60 individuals (both male and female) with chronic generalized periodontitis, who had received a dental panoramic radiograph (DPRs), as a part of their treatment were selected randomly from the Department of Periodontology, Rajarajeswari dental college and hospital Bangalore, Karnataka. Presence of periodontitis was assessed both clinically and radiographically on their panoramic radiographs. The participants were allocated into two groups consisting of 30 individuals each based on their age.

Group I: 30 individuals in the age group of 30 – 44 years and Group II: 30 individuals in the age group of 45 to 60 years.

Patients in the age group of 30 – 60 years and patients with chronic generalized periodontitis (CGP), with at least 15 natural teeth present, having bone loss of more than 2 mm from CEJ and periodontal pocket depth of ≥5mm at more than 30%sites were included in the study.

Exclusion criteria considered were patients with any systemic diseases, patients who received periodontal treatment in last 6 months, patients on any medications affecting calcium metabolism, long-term steroid medication, hormone replacement therapy, pregnant women lactating mothers and smokers.

The probing pocket depth was measured clinically using Williams probe at six sites (mesiobuccal, midbuccal, distobuccal, mesiolingual, distolingual, and midlingual) of each tooth. The study has been approved by the Ethical Committee in Rajarajeswari dental college and hospital Bangalore, Karnataka. Oral and written informed consent

was obtained from all the participants in the study.

RADIOGRAPHIC EXAMINATION

All panoramic images were made using the panoramic machine at 110kv and 100 mA utilizing Kodak films. All the linear measurements were made by using computerized dental software Dental Eye™3 by a single observer.

Following indices[5] were measured on DPRs

1) 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.

On a three-point scale

C1: the endosteal margin of the cortex is even and sharp on both sides.

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.

C3: the cortical layer forms heavy endosteal residues and is clearly porous.

2) Panoramic mandibular index (PMI):

Ratio of the mandibular cortical thickness measured on the line perpendicular to the bottom of the mandible, at the middle of the mental foramen, by the distance between the inferior mandibular cortex and the bottom of the mandible (normal value:≥0.3).

3) Mental index (MI):

Mandibular cortical thickness measured on the line perpendicular to the bottom of the mandible at the centre of the mental foramen (normal value≥3.1 mm).
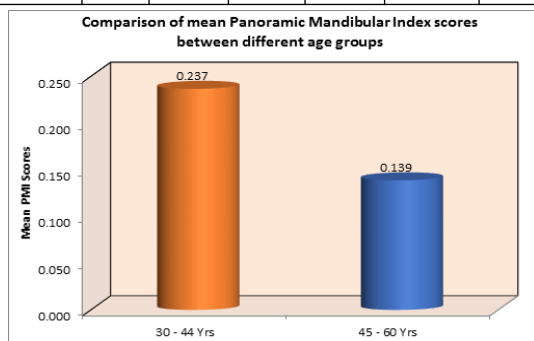
STATISTICAL ANALYSIS

Statistical Package for Social Sciences [SPSS] software was used to perform statistical analyses. Mann Whitney U test was used to compare the mean Panoramic Mandibular Index & Mental Index scores between different age groups. Chi Square Test was used to compare the distribution of Mandibular cortex Index severity between different age groups. The level of significance [P-Value] was set at $P<0.05$.

RESULTS

The study comprised of 60 subjects with groups under examination consisted of same number of patients (15 males and 15 females) in each group [Table 1]. Mann Whitney U test was used to compare the mean PMI and MI between the groups (Table 2). Figure 1 shows slightly higher mean values for PMI in group 1 than group 2 (P =0.24). MI as shown in Figure 2 indicate greater value in group 2 when compared with group 1 (P = 0.26). However, the differences in both groups were not statistically significant. MCI when compared between the two different age groups, C2 and C3 values were higher in group 2 suggestive of higher risk for osteoporosis with advancing age as presented in Table 3 and Figure 3 (P = 0.14).

Table 1: Age And Gender Distribution Of The Subjects

Age and Gender distribution among study subjects						
Gender	30 - 44 Years		45 - 60 Years		χ2 Value	P-Value
	n	%	n	%		
Males	15	50%	15	50%	0.000	1.00
Females	15	50%	15	50%		

Figure 1: Mean Panoramic Mandibular Index Scores Between The Groups
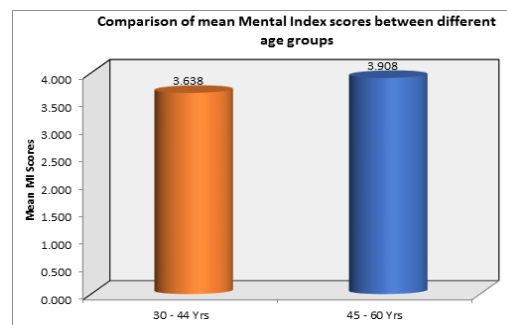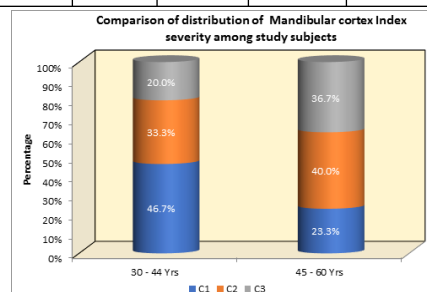

Figure 2: Mean Mental Index Scores Between The Two Groups

Table 2: Comparison Of Mean Panoramic Mandibular Index And Mental Index In Two Groups

Comparison of mean Panoramic Mandibular Index & Mental Index scores between different age groups using Mann Whitney U Test							
Indices	Group	N	Mean	SD	Mean Diff	Z	P-Value
PMI	30 - 44 Years	30	0.237	0.416	0.098	-1.180	0.24
	45 - 60 Years	30	0.139	0.057			
MI	30 - 44 Years	30	3.638	0.753	-0.270	-0.740	0.26
	45 - 60 Years	30	3.908	0.963			

Table 3: Comparison Of Mandibular Cortex Index Between The Groups

Comparison of distribution of Mandibular cortex Index severity between different age groups using Chi Square Test						
MCI	30 - 44 Years		45 - 60 Years		χ2 Value	P-Value
	n	%	n	%		
C1	14	46.7%	7	23.3%	3.986	0.14
C2	10	33.3%	12	40.0%		
C3	6	20.0%	11	36.7%		

Figure 3: Distribution Of Mandibular Cortex Index Among The Groups

DISCUSSION

The prevalence of osteoporosis and the incidence of fracture vary by sex and race/ethnicity. Both men and women experience an age-related decline in BMD starting in midlife. A number of studies have investigated a possible relationship between periodontitis and osteoporosis, and although the literature supports such relationship, its extent remains unclear, due to small sample sizes, noncomparable study populations and different study methods used to assess periodontitis and osteoporosis. In spite of these limitations, recent investigations have been designed to provide more specific information. Preliminary data from the oral ancillary study of the Women's Health Initiative which was designed to determine a possible association between systemic osteoporosis and oral bone loss, suggested a significant correlation between the mandibular basal bone mineral density and hip bone mineral density.[6]

Hildebolt, in a recent review of the literature, states that an association exists between osteoporosis and oral bone loss and mandibular

morphology alters due to osteoporosis.[7] The most commonly studied measures of mandibular morphology on DPRs in relation to osteoporosis include thickness and integrity of inferior border (endosteal and intracortical resorption, respectively) and some radio morphometric indices which can be utilized as tools in detection of low BMD. The goal of such screening is not to diagnose osteoporosis but to identify the risk for bone mass loss and appropriately refer the patient for assessment by bone densitometry.[8]

MCI is a qualitative index of cortical morphology. Results of studies suggest that MCI classification based on panoramic radiographs may be a useful index for the diagnosis of osteoporosis. In this study, MCI appearance was related to the age group of the patients suggesting that increase in age leads to changes in mandibular cortical morphology. C1 was most common in group 1(30 - 44 years). Individuals with C3 appearance was seen in group 2 (45 – 60 years), thus reflecting age related changes. Concurrently, the present study is in agreement with the results of Knezovic- Zlataric et al, reflecting age related changes.[9]

Recently, Dutra et al. showed that the measurement of MI is accurate in panoramic radiographs and representative of the true bone status.[10] Most authors suggest that patients with the thinnest mandibular cortices (≤3 mm) should be referred for further osteoporosis investigation because it is this group that has the highest likelihood of osteoporosis. But, in our study mean values of group II were higher than group I, though they showed no statistically significant differences.

PMI is a radio morphometric method presented in 1991 by Benson et al. It is partly based on the Wical and Swoope method, which suggests a relation between residual ridge resorption and mandibular height below the inferior edge of the mental foramen. They suggest that despite the alveolar bone resorption above the foramen, the distance from the foramen to the inferior border of the mandible remains relatively constant throughout life. The distance below the foramen in a non-resorbed mandible is approximately one third of the total height of the mandible in that region.[11] Thus, the PMI provides a measure of mandibular cortical thickness for normal mandibular size and it could be used for the evaluation of local bone loss in dental practice. Our study reveals higher mean values in group I than group II with no statistically significant difference between two groups.

Limitations of our study may be its smaller sample size and more studies with more patients are needed for this issue.

CONCLUSION
Within the limitations of the study, we can conclude that there is a relationship between OP and periodontitis. So, the study could be used as an ancillary method in the diagnosis of OP, which help the clinicians in early screening of the patients who are at risk of OP.

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