Periodontal Status In Postmenopausal Women With Osteoporosis

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Abstract

Background and objectives: Loss of bone is a common feature of osteoporosis and periodontitis. These diseases may share common etiologic agents which may modulate or affect the process of both diseases. The aim of this present study is to evaluate association between periodontitis and osteoporosis and to assess the relationship between oral bone loss and osteoporosis in postmenopausal women. Methodology: This study is done in a cross sectional design involving 200 Postmenopausal women. On the basis of exclusion and inclusion criteria 115 patients were selected. They were scanned using dual energy X-ray absorptiometry (DEXA). Out of 115 patients, 77 got included in the study after being diagnosed as osteoporotic by measuring bone mineral density with DEXA. Clinical examination parameters included Plaque index, Calculus index, Gingival index, Gingival Bleeding Index, Probing Depth and Clinical Attachment Level. Panoramic radiographs are obtained from all the patients. For assessment of periodontitis, radiographic parameters included are alveolar bone support ratio (ABR). Osteoporotic parameter for assessing oral bone loss included alveolar bone loss of the mandible and morphology of the mandibular cortical index. Results: Clinical attachment level was negatively correlated with the bone mineral density and there was a statistically significant difference between clinical attachment level and bone mineral density with p value 0.000. Alveolar bone support ratio was strongly correlated with bone mineral density and there was a statistically significant difference between alveolar bone support ratio and bone mineral density with p value 0.000. Bone mineral density was positively correlated with the number of teeth present and there was a statistically significant difference between these two parameters. Oral bone loss of the mandible was positively correlated with bone mineral density and there was no statistically significant difference between oral bone loss of the mandible and bone mineral density. Bone mineral density was negatively correlated with mandibular cortex index. Conclusion: The results suggested risk of progression of periodontal disease, with increased tooth loss for postmenopausal women with osteoporosis.

Keywords: Bone loss, risk factors, postmenopause, osteoporosis, periodontal disease.

1. Introduction

Periodontal disease and osteoporosis are multifactorial in nature and involve majority of the population in India and over the world. Osteoporosis is a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of the bone scaffold that results in increased bone fragility and susceptibility to fracture whereas Periodontitis is an inflammation of the supporting tissues of the teeth usually leading to loss of bone and periodontal ligament constituting a major cause of tooth loss and edentulousness in adults.[1]

In most women, peak of bone mass will be seen in

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age between 20 to 30 years and thereafter declines. With the onset of menopause, the reduction in bone mass can be further aggrevated. In addition to systemic manifestations in menopause, oral changes are visible which include thinning of the oral mucosa, burning mouth, recession of gingiva, dryness of mouth, taste sensation is modified, bone loss and alveolar ridge resorption.[2] Postmenopausal women are worst effected with osteoporosis. They have high chances to show an aggrevated response to plaque,resulting in increased bleeding on probing, a reduction in dentoalveolar bone height and subcrestal bone.

There is increasing interest in interrelationship between, oral bone loss, tooth loss, systemic osteoporosis and periodontal disease in recent years,. The hypothesis is there might be breakdown of periodontal tissue relative to systemic conditions that may predispose the patient to osteoporosis.[3]. Reduction in bone mineral density (BMD), disruption of bony microarchitecture and alteration in the amount and variety of non-collagenous proteins in bone is seen in osteoporosis due to reduction in bone mineral dentisty [4]. There may be increased susceptibility to resorption of alveolar bone due to reduction in bone mineral dentisty. This can be considered as a risk factor for loss of alveolar process and oral bone suggesting the possibile association between osteoporosis and periodontal disease with tooth loss.[5] Furthermore, patients with osteoporosis showed a greater incidence of edentulous condition and retain fewer natural teeth.[6]

Positive correlation between systemic osteoporosis and periodontal disease was shown in many previous studies (Al Habashneh et al., 2010; Choi et al., 2017; Mongkornkarn et al., 2019; Richa, Puranik, & Shrivastava, 2017) whereas few authors had dissenting opinion (Marjanovic et al., 2013; Sultan & Rao, 2011) regarding the same. Due to this heterogeneity in the currently available scientific data, this study was undertaken among post menopausal women to envisage the association between periodontal disease and osteoporosis.

2. Methodology

Present study was cross sectional, observational evaluation of 200 Postmenopausal women. For the study, women in the outpatient department of an Endocrinology hospital, Guntur AP were recruited. All participants were thoroughly informed about the methodology of the study.From institutional ethical committee,written informed consent was taken after approval [1].

Postmenopausal women aged between 50-65 years with presence of atleast 7 natural teeth in jaw without any systemic disease like cancer were included in this study.Individuals on long term steroid or any antibiotic medication for more than 6 months, who had hysterectomy or experienced any non vertebral and veterbral osteoprotic fractures, smokers or individuals with any endocrine and metabolic bone disease or any bone destructive lesions in the jaw that could affect the result of the study were excluded.

After the initial screening of 200 postmenopausal women, based on exclusion and inclusion criteria,115 patients were selected. Using a Hologic QDR-4500 scanner by dual energy X-ray absorptiometry (DEXA), bone mineral density (BMD) was measured (fig 1,2). Of 115 patients, After being diagnosed as osteoporotic based on bone mineral density ,medical history, data collected regarding the age of commencement of menopause, years after menopause, BMI, and estrogen supplementation, 77 were included in the study.

3. Clinical Evaluation

All participants were evaluated for clinical parameters which included number of teeth present, Plaque index (Silness and Loe 1964)7, Calculus index8, Gingival index (Loe and Silness 1963)9, Gingival bleeding index (Ainamo and Bay index 1975)10, Probing depth (PD), Clinical attachment level (CAL)

Radiographic Parameters

Panoramic radiographs were collected for all the 77 participants.

1. Alveolar bone support ratio(ABR)
2. Mandibular cortical index(MCI) and
3. Alveolar bone loss(ABL) of the mandible

1. Alveolar Bone Support Ratio (Abr)

On both the distal and mesial surfaces of the entire tooth excluding molars, alveolar bone loss was measured on panoramic radiographs. Alveolar bone support ratio (ABR) was measured as the ratio of supporting bone height (B) to root length(R).

B= height of that root surface at which periodontal ligament space is considered normal width.

R = Height from cemento-enamel junction to most apical point of the root.

The mean ABR was obtained for each subject.11

2. Mandibular Cortical Index (Mci)

Mandibular cortex was detected from distal side of mental foramen. They were classified into 3 groups[12]:

4. C1 –Normal cortex with the endosteal margin even on both the sides
5. C2- Moderately eroded cortex with endosteal margin showing semi lunar defects (lacunar resorption) or seemed to form endosteal cortical residues (one to three layers) on one or both the sides.
6. C3- Severely eroded cortex where cortex formed heavy endosteal cortical residues and was clearly porous.

3. Alveolar Bone Loss (Abl) Of The Mandible

By a method described by Wical and Swope ,the alveolar bone loss (ABL) was measured [13]. Unilateral measurements were made depending on the presence of teeth. The inferior edge of the mental foramen was traced and a line parallel to the long

axis of the mandible and tangential to the inferior border of the mandible was drawn. A line perpendicular to this tangent intersecting the inferior border of the mental foramen was constructed. All the measurements were made in mm with a plastic mm ruler. From the lower border of the mandible to the top of the alveolar crest (mandibular total bone height).The distance from the lower border of the mandible to the inferior edge of the mental foramen (basal bone height).

Alveolar bone loss= Mandibular total bone height (TBH)/ Basal bone height (BBH).

Low TBH/BBH ratio indicates high alveolar bone loss of the mandible.

4. Results

Using various software technologies namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 ,Systat 12.0 and R environment ver.2.11.1, in present study, descriptive statistical analysis was done, for the analysis of the data by a statistician who was blind to the respective study. Between and within study groups, comparison of mean values were carried out by Student's T test and Analysis of variance (ANOVA) respectively. Pearson correlation co-efficient has been used to find the relationship of ABL, ABR and BMD with other parameters. 5 % level of significance is assessed with confidence interval at 95%.

The study included 77 postmenopausal women aged between 50-65 yrs with a mean age of 56.82±4.02 years. Relation between age, onset and years after menopause with distribution of BMI and estrogen supplementation has been tabulated in table 1.

Periodontal parameters like PI, GI, GBI decreased as age and years of menopause increased whereas CI and CAL positively increased for the same. PI decreased as BMI increased. Between the two parameters,there was a statistically significant difference with p value 0.037.(Table 2)

Pearson correlation(r) with study variables

The mean clinical attachment level was 5.44±0.34 (Table 2). Years of menopause, age and age at menopause were positively correlated with CAL and with BMD, it was negatively correlated (r=-0.50) , ABR (r=-0.477). There was a statistically significant difference between the parameters.

Alveolar bone support ratio was negatively correlated with age (r=-0.86 with p value 0.00), age of menopause(r=-0.16 with p value 0.00) and years of menopause (r=-0.84 with p value 0.00). There was statistically significant difference between ABR and number of teeth present with p value 0.013. It was strongly correlated with CAL(r=-0.477 with p value 0.00) and BMD(r=0.794 with value 0.000)(Table 4).

Alveolar bone loss of the mandible was between 2.1-2.5mm for 71.4% with 5.2% of the cases having ≤2.00mm with mean ABL being 2.42±0.22. ABL was not correlated with age(r=-0.001), years of menopause(r=-0.05), age at menopause(r=0.02), PI(r=0.08), CI(r=0.06), number of teeth present (r=0.04), CAL(r=-0.16), ABR(r=0.059) and BMD(r=0.36). It was negatively correlated with PD(r=-0.38) with statisticallysignificant difference. BMD was negatively correlated with age(r=-0.92), age at menopause(r=-0.70), years of menopause(r=-0.89) CAL(r=-0.50) showing statistically significant difference (p =0.00). It was positively correlated with number of teeth present (p = 0.01). Also showed strong correlation with ABR(p =0.000).(Table 5).

Category C1 was only seen in the Mandibular cortical index (27.3%) and C2 (72.7%) with none of the cases presenting in the C3 category.With increased PI, CI, GI, the mandibular cortical index C2 increased . It was correlated positively with PD (p<0.001) and CAL (p=0.021) whereas correlated negatively with ABL andwith p value <0.001. (Table 6)(Graph 1)

5. Discussion

Periodontal disease and Osteoporosis share common risk factors. These diseases are seen mainly after the age of 35 years.[8] With advancing age in women, chances of both osteoporosis and tooth loss increase . Osteoporosis has long been suspected as a risk factor for oral bone loss, associated with periodontal infection. The hypothesis for association among these factors is increase in cytokines (i.e. interleukin-1 and interleukin-6). They may effect any bone in the body, including oral cavity[8]resulting in less crestal alveolar bone per unit volume. This less density bone may lead to more rapid bone height loss when periodontal infection triggers a stimulus for resorption .[14] Other risk factors such as diabetes, diet and hormone levels affect systemic bone level and also periodontitis.[15]Various studies in literature have related different mechanisms by which osteoporosis may effect periodontal attachment loss, alveolar bone height reduction and loss of tooth but it is less understood about the possible mechanism behind such association and still continues to be explored. Hence, in this cross sectional study an attempt has been made to evaluate periodontal findings in 77 postmenopausal women with osteoporosis to understand the association between periodontal disease and osteoporosis.

Among all periodontal parameters, clinical attachment level was correlated positively with age of menopause, years of menopause and negatively correlated with the BMD which were statistically significant indicating that CAL increased with increase in the age, age at menopause and years of menopause in consistent with study by Hildebolt CF[16]. Rate of breakdown of connective tissue components of the gingiva by stimulation of matrix metalloproteinases(MMP-8 and MMP-13) is increased in postmenopausal women due to decrease in estrogen following menopause [5]indicating the association between periodontal disease and menopause

Different methods for analysis of systemic bone loss in osteoporosis have been proposed like dual photon absorptiometry, dual energy X-ray

absorptiometry (DEXA), single photon absorptiometry and quantitative computed tomography, among which Dual energy X-ray absorptiometry (DXA, formerly DEXA) is considered as the gold standard for diagnosis of systemic osteoporosis and has been opted in the present study. Systemic BMD measured by DEXA had showed negative correlation with age, age at menopause and years of menopause which was statistically significant, indicating that increased in age and years of menopause were associated with low BMD [617] that could be due to estrogen depeletion in first few years after menopause associated consequent rapid bone loss. Also it was strongly associated with the number of teeth present with statistically significant difference suggesting that osteoporotic patients with low BMD had decreased number of teeth, which was consistent with the other studies. [171819] On contrary no difference was observed significantly between BMD and alveolar bone loss of the mandible similar to results by Kshii et al [20] .

To confirm the effect of osteoporosis on oral/jaw bone DEXA of the mandible could not be taken as it was not feasible in the study centre. Hence in this study, two indices [Mandibular cortical index (MCI) and alveolar bone loss (ABL) of the mandible along with alveolar bone support ratio (ABR)] were taken to confirm osteoporosis of the jaw bone for the patients that was assessed using panaromic radiographs. Studies done by Akkersson et al21 showed that there were only small differences in measurements of marginal bone loss between periapical, panoramic and bitewing radiographs. Furthermore, Molander et al22 had shown that panoramic radiographs can be used for assessing marginal bone loss. Mandibular cortex indices identified by thinning of the cortex at the lower border of the mandible in the dental panoramic radiograph have been developed to allow quantification of mandibular bone mass and osteoporosis identification.23 In present study, patients in MCI C2 (0.73605) category had comparably lower BMD than MCI C1(0.73971) but did not attain statistical significance, which was in similar to results obtained by Persson et al 200124, Anne Marie 200025. Also present study revealed strong correlation of ABR with age, age of menopause and years of menopause, suggesting the role of menopause on ABL could be possibly due to deficiency of estrogen that elevates Interluekin-6 concentration in the bone and in gingiva, further accelerating osteoclast bone resorption. It was also strongly correlated with BMD indicating that women in postmenopause stage with low bone mineral density had less alveolar bone support. This effect of osteoporosis on periodontitis could be explained by the increased proinflammatory cytokines such as interleukin -1, interleukin-6, tumor necrosis factor and prostaglandins produced during osteoporosis, that have a stimulating effect on the bone resorption, by affecting differentiation of osteoblast which supports the previously suspected association between osteoporosis and alveolar bone loss.8, 26, 12 However, ABR did not show any corelation with periodontal parameters including PI, CI, GI, GBI and PD, in contrast, to Tezal et al.8

The findings from the above study had revealed a strong correlation between ABR and BMD in postmenopausal osteoporotic patients associated with lesser number of teeth due to loss of crestal bone surrounding teeth. However this stud had few drawbacks which included its design, sample size and also lack of more sophisticated diagnostic aids like dual energy X-ray absorptiometry (DXA) or subtraction radiography for assessing oral/jaw bone.

6. Conclusion

In the present study results suggest that systemic bone loss was associated with clinical attachment level and alveolar bone support ratio indicating an association between osteoporosis and periodontitis. It was weakly related with oral bone loss of the mandible may be because the size of sample was small. Within limits of this study, it can be inferred that postmenopausal women with osteoporosis are at risk for progression of periodontal disease, with increased tooth loss. But, future researchs based on large well designed, longitudinal prospective study along with advanced sophisiticated diagnostic aids are in need to substantiate this association between osteoporosis, periodontitis and oral bone loss and to create awareness with various preventive strategies and efficient interdisciplinary management to maintain both systemic bone health and periodontal health.

References

Menegassi VM, Jaime M, Rechenchosky L, Borges P, Zavalla S, Rinaldi W. Demanda física y fisiológica de jóvenes futbolistas durante juegos oficiales y reducidos. Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte. 2022;22(85):59-70.
https://doi.org/10.15366/rimcafd2022.85.005

American academy of periodontology. Glossary of periodontal terms, 4th edition. Chocago: The American Academy of periodontitis; 2001:39.

Joan Otomo-Corgel: Periodontal therapy in the female patient In: Carranza`s Clinical Periodontology, Michael G.Newman, Henry H.Takei, Fermin A. Carranza, 10th Edition, W.B.Saunders 2007; 636-649.

Yu-Lin Lai. Osteoporosis and Periodontal Disease, J Chin Med Assoc 2004; 67:387-388.

Willaim V.Giannobile, Hectro F, Rios and Niklaus P.Lang.: Bone as a tissue. In: Clinical periodontology and implant dentistry Jan Lindhe, Niklaus P.Lang and Thorkild Karring. 5th edition 2007:86-94.

Marcelo R. Marques A.D. da Silva Silvina P: Periodontal disease and osteoporosis association and mechanisms: A review. Braz J oral Sci 2003; 2: 1-5.

Elders PJ, Habets LL, Netelenbos JC, vander Linden

LW, vander Stelt PF. The relation between periodontitis and systemic bone loss in women between 46 and 55 years of age. J Clin Periodontol 1992; 19:492-6.
Silness J, Loe H. Periodontal disease in pregnancy (II): Correlation between oral hygiene a periodontal conditions Acta Odontol Scand 1964; 22:121-35.
Mine Tezal, Jean Wactawski-Wende, Sara G.Grossi, Alex W. Ho, Robert Dunford & Robert J. Genco: The relationship between bone mineral density and periodontitis in postmenopausal women. J Periodontol 2000; 71: 1492-1492.
Loe H & Silness J: Periodontal disease in pregnancy. Acta Odontol Scand 1963; 21: 533-551.
Ainamo. J and Bay. I: Problems and proposals for recording gingivitis and plaque. Int Dent J 1975; 25:229-35.
Klemetti E , Collin H-L, Fores H, Markkanen H & Lassila V : Mineral status of skeleton and advanced periodontal disease. J Clin Periodontol 1994; 21:184-188.
Klemetti E,Kolmakov S , Kroger H: Pantomography in assessment of the osteoporosis risk group. Scand J Dent Res 1994; 102: 68-72.
Wical KE, Swoope CC: Studies of residual ridge resorption .part I. Use of panoramic radiographs for the evaluation and classification of mandibular resorption .J Prosthet Dent 1974; 32: 7-12.
Jean Wactawski-Wende, Sara G. Grosi, Maurizio Trevisan et al: The role of osteopenia in oral bone loss and periodontal disease. J Periodontol 1996; 67: 1076-1084.
Nico C.Geurs, Cora Elizabeth Lewis and Marjorie K. Jeffcoat: Osteoporosis and periodontal disease progression. Perio 2000 2003; 32: 105-110.
Hildebolt CF, Pilgram TK, Dotson M, Yokoyama-Crothers N , Muckerman J, Hauser J, Cohen S , Kardaris E , Vannier M.W , Shrout M.K & Civitelli R : Attachment loss with postmenopausal age and smoking. J Periodont Res 1997; 32: 619-625.
A.Taguchi, Y. Suei, M. Ohtsuka, K.Tanimoto and LG Hollender : Relationship between bone mineral density and tooth loss in elderly Japanese women. Dentomaxillofacial radiology 1999; 28: 219-223.
K.Inagaki, Y. Kurosu, T.Kamiya, F. Kondo, N.yoshinari, T. Naguchi, E.A.Krall & R.I.Garcia : Low bone mineral density, tooth loss, and periodontal disease in Japanese women. J Dent Res 2001; 80 : 1818-1822.
Nicopoulou-Karayianni, kety. Tzoutzoukos et al: Tooth loss and osteoporosis: The osteodent study. J Clin Periodontol 2009;
K Ishii, A Taguchi, T Nakamoto, P Sutthiprapaporn, M Tsuda et al: Diagnostic efficacy of alveolar bone loss of the mandible for identifying postmenopausal women with femoral osteoporosis. Dentomaxillofacial Radiology 2007; 36: 28-33.
Akkersson L, Hakansson J, Rohlin M. Comparison of panoramic and intraoral radiography and pocket probing for the measurement of the marginal bone level. J Clin Periodontol 1992; 19: 326-332.
Molander B, Ahlqwist M, Grondahl HG, Hollender LG. Agreement between panoramic and intraoral radiography in the assessment of marginal bone height. Dentomaxillofac Radiol 1991; 20: 155-160.
B Cakur, A.Sahin, S Dagistan, O Altun, F Caglayan: Dental panoramic Radiography in the diagnosis of osteoporosis. The Journal of International Medical Research 2008; 36: 792-799.
Persson RE, Hollender LG, Powell LV, Mac Entee MI, Wyatt CCL, Kiyak HA & Persson GR : Assessment of periodontal conditions and systemic disease in older subjects I. Focus on osteoporosis. J Clin Periodontol 2002; 29: 796-802.
Anne-Marie Bollen,Akira Taguchi,Phillippe P.H & Lars G. Hollender : Case-control study on self-reported osteoporotic fractures and mandibular cortical bone. Oral surg Oral Med Oral Pathol Oral Radiol Endod 2000 ; 90 : 518-24.
Payne JB, Reinhardt RA, Nummikoski PV, Dunning DG, Patil KD. The association of cigarette smoking with alveolar bone loss in postmenopausal females. J Clin Periodontol 2000; 27: 658–664.