

Evaluation of the Association Between Periodontal Parameters, Osteoporosis and Osteopenia in Post Menopausal Women

Amir Moeintaghavi¹, Monireh Pourjavad², Sepideh Dadgar^{3✉}, Najmeh Shayesteh Tabbakh⁴

¹Department of Periodontics, Faculty of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

²Department of Gynecology, Imam Reza Hospital, Mashhad University of Medical Sciences, Mashhad, Iran

³Post Graduate Student, Department of Orthodontics, Dental Faculty, Islamic Azad University Khorasgan (Isfahan) Branch, Khorasgan, Iran

⁴Bs, Midwife, Mashhad, Iran

Abstract

Objective: Different studies have reported contradictory results about the effect of osteoporosis on periodontal status. We performed this study to evaluate the periodontal status of menopausal women by methods with enough accuracy and confidence.

Materials and Methods: This study was performed based on the evaluation of bone mineral density using dual energy X-ray absorptiometry in 2010. A total of 60 patients who met the inclusion criteria were selected and divided into three groups of osteoporosis, osteopenia, and normal. Then, evaluation of periodontal markers such as pocket depth (DP), attachment loss (AL), and tooth loss (TL) was performed by a dental student. A panoramic radiography was performed for those who were suspicious of periodontal disease and bone decline. Finally, evaluation of the periodontal indexes was compared among the three groups using ANOVA with 95% confidence interval.

Results: Mean bone decline was higher in the osteoporosis group compared to the other two groups, but the difference was not significant ($P=0.065$). In addition, mean of plaque index ($P=0.123$), pocket depth ($P=0.856$), attachment loss ($p=0.525$), and tooth loss ($p=0.884$), the number of people with attachment loss ≥ 2 millimeter ($P=0.866$) and the number of people with alveolar bone loss ≥ 2 millimeter ($P=0.348$) were not significantly different between the three groups.

Conclusion: In this study, no significant difference was observed between the three groups in terms of plaque index, pocket depth, attachment loss, or tooth loss. However, further studies are required that could control all the possible confounding variables.

Key Words: Osteoporosis; Bone Demineralization, Pathologic; Periodontitis; Menopause

Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2013; Vol. 10, No. 5)

✉ Corresponding author:

S. Dadgar, Department of Orthodontics, Dental Faculty, Islamic Azad University Khorasgan (Isfahan) Branch, Isfahan, Iran

dadgar_sepideh@yahoo.com

Received: 14 March 2013

Accepted: 2 August 2013

INTRODUCTION

Iran has experienced exceptional demographic changes in the past few decades [1] that has resulted in an increase in the life expectancy to

about 70.5-75.6 years depending on the geographical region [2]. In addition, the number of adults over the age of 64 has increased from 1.2 million in 1976 (3.7% of the population) to

3.5 million in 2006 (5.5% of the population) [1]. As a result, the incidence of age-related diastases has significantly increased.

Menopause is a physiological event that occurs approximately at the age of 50 due to interruption in the menstrual cycle and results in irreversible hormonal changes [3]. Osteoporosis is a skeletal disorder characterized by significant reduction in bone mineral density (BMD) or 'too little bone in the bone', which increases the risk of bone fracture. Osteoporosis is the most common metabolic bone disorder that results in a major public health issue. The incidence of osteoporosis is increasing as the world moves towards a more aging population [4-6]. According to a study conducted by Maddah et al. [7] in Iran the prevalence of osteoporosis is higher in postmenopausal women.

Periodontitis is a destructive inflammatory disease of the supporting tissue of the teeth, characterized by loss of connective tissue and alveolar bone. Like osteoporosis, periodontitis is a silent disease, which does not cause any sign or symptom until late stages of the disease that is revealed by mobile teeth, abscesses or tooth loss [8, 9].

Periodontitis causes tooth loss [10] similar to osteopenia and osteoporosis that in severe cases is related to alveolar bone and tooth loss in women after menopause [11, 12]. A number of cross sectional studies have looked at the relationship between bone mineral density (BMD) of postmenopausal women and tooth loss. However, only a few studies reported statistically significant correlation between reduced BMD at varying sites and tooth loss [13].

Krall et al. found that only tooth count and lumbar bone mineral density are significantly correlated [14]. Significant association between femoral neck bone mineral density and tooth loss was reported in another study [15]; however, in the aforementioned study, the correlation between the spinal bone mineral density and tooth loss was not significant.

On the other hand, specific Interleukin-1 gene polymorphisms, as an important mediator of inflammation and bone destruction in the periodontium, and vitamin D gene have been identified as a receptor [16]. This study was conducted to evaluate the potential association between osteoporosis and periodontal indices such as plaque index (PI), pocket depth (PD), attachment loss (AL), alveolar bone loss (BL) and number of tooth loss (TL) among postmenopausal Iranian women in order to clarify some of the existing controversies.

MATERIALS AND METHODS

Twenty subjects were selected per group based on the results of the study by Khorsand et al. [18] using the following formulation:

$$n = \frac{(s_1^2 + s_2^2)(\delta_{1-\frac{\alpha}{2}} + \delta_{1-\beta})^2}{(\bar{x}_1 - \bar{x}_2)^2}$$

$$n = \frac{(6/4^2 + 4/5^2)(1/96 + 0/84)^2}{(7/25 - 12/25)^2} \approx 20$$

Therefore, in the current cross-sectional study, 60 postmenopausal women above the age of 50 (51-75 years old; mean age, 52±1.72) were admitted to the densitometry clinic at Mashhad University of Medical Sciences, Imam Reza Hospital. Menopause is referred to a stage in life, where the subject will no longer experience menstrual flow, and in this study we considered 12 consecutive months with no menstrual flow as menopause. Postmenopausal women with at least 10 natural teeth except for 3rd molars were included. All the approved subjects signed a consent form before being enrolled in the study.

The selection criteria excluded subjects requiring antibiotic prophylaxis; those with parathyroid and metabolic bone diseases, diabetes, a positive history of immunosuppressive therapy; and addiction. All the participants had followed the oral hygiene measures, evaluated by twice brushing per day in the past 2 years. BMDs of the lumbar spine and right femoral neck were measured using the dual-energy X-

ray absorptiometry method (DEXA) by a trained X-ray technician. This method allowed us to classify the subjects to osteoporosis, osteopenia or normal bone density based on site- and gender-specific cut-off values of the standard deviations (T-scores) compared to a reference group of young normal adults. A T-score below -2.5 was considered as osteoporosis; between -1.5 and -2.5 was classified as osteopenia; between -1.5 and -1 was classified as mild osteopenia and a T-score over -1 was considered as normal [17]. The same endocrinologist conducted the exclusion process and the study subjects were selected among the people whose osteoporosis was due to their menopause. The study population was equally divided into three groups: osteoporosis, osteopenia and normal groups.

Periodontal examinations were performed on all teeth except for the 3rd molars by a blind examiner and consisted of: 1) plaque index (PI), 2) pocket depth (PD), 3) attachment loss (AL) 4) alveolar bone loss (BL), and 5) number of tooth lost (TL). PI was assessed based on O'Leary index. A dental mirror, an explorer and a Williams periodontal probe were used for clinical evaluation.

Alveolar BL was evaluated using panoramic radiography; we measured the distance between the CEJ and alveolar crest using a digital caliper in mm. All of the periodontal parameters were evaluated for all subjects (n=60).

Statistical Analysis

Statistical analysis was performed using SPSS for Windows version 11.5 (SPSS Inc., Chicago, Illinois, USA)). Descriptive statistics including means, standard deviations, ranges, and percentages were calculated for all variables (PI, PD, AL, BL and TL) between the three subject groups. ANOVA or Kruskal Wallis tests were used to compare variables between the groups. A p-value less than 0.05 was considered significant.

RESULTS

Twenty patients were selected in each group: osteoporosis (mean age 56), osteopenia (mean age 52.31) and normal (mean age 50.85) groups. There were no significant differences between the groups according age (P=0.065). The differences between T scores in three groups were statistically significant (P=0.000) (Table 1).

Table 1. T Scores in Different Groups

Groups	N	Tscore Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Osteoporosis	20	-3.1105	.49314	.11313	-3.3482	-2.8728	-4.20	-2.27
Osteopenia	20	-1.4053	.54189	.12432	-1.6664	-1.1441	-2.40	-.10
Normal	20	.6495	1.16897	.24922	.1313	1.1678	-.60	3.80
Total	60	-1.1918	1.76484	.22784	-1.6477	-.7359	-4.20	3.80

No significant difference was observed in alveolar bone loss between the osteoporosis, osteopenia and normal groups ($P = 0.06$; $F=2.89$). However, patients with osteoporosis had higher percentages of alveolar bone loss compared to the osteopenic and normal individuals. The plaque index in osteoporotic women was higher than the other two groups, but this difference was not statistically significant ($P=0.12$; $F=2.17$). In the present study, there were no significant differences in the other recorded periodontal parameters such as pocket depth, attachment loss and number of tooth loss between the three groups ($P<0.05$) (Table 2).

DISCUSSION

The current cross-sectional study was carried out to assess the relationship between periodontal diseases and osteoporosis in Iranian postmenopausal women. Individuals above the age of 50 were selected for this study as it had previously been reported that age-related loss of bone was more prominent in women after the age of 50 compared to those below 50 years of age [19].

Systemic factors of bone remodeling may also modify local tissue response to periodontal infections, so all subjects having a history of metabolic bone diseases, parathyroid disease or cancer were excluded from the study.

In the present study, we evaluated and compared some periodontal parameters like alveolar bone loss, pocket depth, plaque index, attachment loss and number of tooth loss between osteoporotic, osteopenic and normal groups of post menopausal women. No significant association was observed between the changes in BMDs and number of teeth lost. However, comparison of alveolar bone loss between the three subject groups showed women with osteoporosis have a higher amount of alveolar bone loss compared to the osteopenic and normal individuals, but this difference was not significant.

The result of the current study was similar to that reported by Lundström et al. [20], who examined the periodontal conditions of 210 women at the age of 70 and compared an osteoporotic group to a control group with normal BMD from a sample population of Linköping community.

Table 2. Mean and Standard Deviation of Periodontal Variables in Osteoporosis, Osteopenia and Normal Groups

Variables	Osteoporosis	Osteopenia	Normal	P-value
Alveolar Bone Loss (mm)	3.37±0.74	2.88±0.92	2.80±0.58	0.06
Plaque index (%)	87.45±16.59	85.8±10.26	78.65±14.96	0.12
Pocket depth (mm)	1.18±0.28	1.20±0.28	1.155±0.33	0.85
Attachment loss (mm)	1.64±0.81	1.42±0.67	1.44±0.50	0.52
Number of tooth loss	4.1±0.73	4.7±1.02	4.45±0.79	0.88

Lundström et al. [20] did not show any significant difference in periodontal conditions or marginal bone level between the osteoporotic and control group. It seems that osteoporosis does not increase the incidence of periodontal diseases perhaps due to its effect on bone quality rather than the quantity. On the contrary, Payne et al. [21] reported that osteoporosis/osteopenia and estrogen deficiency are risk factors for alveolar bone density loss in postmenopausal women with a history of periodontitis.

The aforementioned study was a 2-year longitudinal clinical study, where the alveolar bone height and density changes were compared between two groups of women with osteoporosis/osteopenia and normal lumbar spine bone mineral density (BMD). In addition, Sultan and Rao [22] reported that skeletal BMD is related to interproximal alveolar bone loss and clinical attachment loss, though not to a statistically significant level; implicating postmenopausal osteopenia as a risk indicator for periodontal disease.

The controversies observed between the results of the present study and other studies may be due to limitations such as the cross sectional nature of the current study, small sample size or lack of controlling confounding factors.

CONCLUSION

In conclusion, within the limitations of the present study, changes in examined periodontal indices such as plaque index, pocket depth, alveolar bone loss, attachment loss and number of tooth loss were not associated with BMD changes in Iranian postmenopausal women. Further longitudinal studies with larger sample size might be necessary to substantiate our findings.

REFERENCES

1- Sarraf-Zadegan N, Boshtam M, Malekafzali H, Bashardoost N, Sayed-Tabatabaei FA, Rafiei M et al. Secular trends in

cardiovascular mortality in Iran, with special reference to Isfahan. *Acta Cardiol.* 1999 Dec;54(6):327-33.

2- Farzadfar F, Danaei G, Namdaritabar H, Rajaratnam JK, Marcus JR, Khosravi A et al. National and subnational mortality effects of metabolic risk factors and smoking in Iran: a comparative risk assessment. *Popul Health Metr.* 2011 Oct 11;9(1):55-66.

3- Soules MR, Sherman S, Parrott E, Rebar R, Santoro N, Utian W et al. Executive summary: Stages of Reproductive Aging Workshop (STRAW). *Climacteric.* 2001 Dec;4(4):267-72.

4- Nordin BE. Redefining osteoporosis. *Calcif Tissue Int.* 2008 Dec;83(6):365-7.

5- Krejci CB. Osteoporosis and periodontal disease: is there a relationship? *J West Soc Periodontol Periodontol Abstr.* 1996;44(2):37-42.

6- NIH Consensus Development Panel on Osteoporosis, and Therapy. Osteoporosis prevention, diagnosis, and therapy. *JAMA.* 200 Feb 14;285(6):785-95.

7- Maddah M, Sharami SH, Karandish M. Educational difference in the prevalence of osteoporosis in postmenopausal women: a study in northern Iran. *BMC Public Health.* 2011 Nov 3;11:845-8.

8- Papapanou PN. Epidemiology of periodontal disease: an update. *J Int Acad Periodontol.* 1999 Oct;1(4):110-6.

9- Burt B; Research, Science and Therapy Committee of the American Academy of Periodontology. Position paper: epidemiology of periodontal diseases. *J Periodontol.* 2005 Aug;76(8):1406-19.

10- Mohammad AR, Jones JD, Brunsvold MA. Osteoporosis and periodontal disease: a review. *J Calif Dent Assoc.* 1994 Mar;22(3):69-75.

11- Wactawski-Wende J, Grossi SG, Trevisan M, Genco RJ, Tezal M, Dunford RG et al. The role of osteopenia in oral bone loss and periodontal disease. *J Periodontol.* 1996 Oct;67(10 Suppl):1076-84. Review.

12- Birkenfeld L, Yemini M, Kase NG, Birkenfeld A. Menopause-related oral alveolar bone resorption: a review of relatively unexplored consequences of estrogen deficiency. *Menopause.* 1999 Summer;6(2):129-33.

13- Megson E, Kapellas K, Bartold PM. Relationship between periodontal disease and

- osteoporosis. *Int J Evid Based Healthc.* 2010 Sep;8(3):129-39.
- 14- Krall EA, Dawson-Hughes B, Papas A, Garcia RI. Tooth loss and skeletal bone density in healthy postmenopausal women. *Osteoporos Int.* 1994 Mar;4(2):104-9.
- 15- Taguchi A, Fujiwara S, Masunari N, Suzuki G. Self-reported number of remaining teeth is associated with bone mineral density of the femoral neck, but not of the spine, in Japanese men and women. *Osteoporos Int.* 2004 Oct;15(10):842-6.
- 16- Inagaki K, Krall EA, Fleet JC, Garcia RI. Vitamin D receptor alleles, periodontal disease progression, and tooth loss in the VA dental longitudinal study. *J Periodontol.* 2003 Feb;74(2):161-7.
- 17- Kanis JA. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis: synopsis of a WHO report. WHO Study Group. *Osteoporosis Int.* 1994 Nov;4(6):368-81.
- 18- Khorsand A, Paknejad M, Vakili F. [Evaluation of periodontal condition of menopause women with osteoporosis and osteopenia and comparison with control group] [Article in Persian]. *J Dent Med.* 2006;19(3):76-83.
- 19- López-Marcos JF, García-Valle S, García-Iglesias AA. Periodontal aspects in menopausal women undergoing hormone replacement therapy. *Med Oral Patol Oral Cir Bucal.* 2005 Mar-Apr;10(2):132-41.
- 20- Lundström A, Jendle J, Stenström B, Toss G, Ravald N. Periodontal conditions in 70-year-old women with osteoporosis. *Swed Dent J.* 2001;25(3):89-96.
- 21- Payne JB, Reinhardt RA, Nummikoski PV, Patil KD. Longitudinal alveolar bone loss in postmenopausal osteoporotic/osteopenic women. *Osteoporos Int.* 1999;10(1):34-40.
- 22- Sultan N, Rao J. Association between periodontal disease and bone mineral density in postmenopausal women: a cross sectional study. *Med Oral Patol Oral Cir Bucal.* 2011 May 1;16(3):e440-7.