

Periodontal Attachment Loss and Bone Mineral Density in Elderly Patients

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Abstract

Osteoporosis and periodontitis are two independent diseases. These two diseases are related to both damage bone and tissue, and common risk factor older age. This study was to analyze the relationship of periodontal attachment loss and bone mineral density in elderly patients.

A cross-sectional study in 62 elderly patients 50-62 years old, conducted in Dental Hospital, Universitas Indonesia, Jakarta. Clinical attachment loss (CAL) were measured by using periodontal probe in six sites on each tooth except the third molar, than it classified into moderate (3-4mm CAL) and severe (≥ 5 mm of CAL). Bone ultra sonometer was used to measure bone mineral density (BMD) of calcaneus bone. BMD values were expressed as a T-score.

Twenty-one male and 41 female subjects were participated in this research. There were seven subjects (11.3%) of moderate CAL and 55 subjects (88.7%) of severe CAL. The BMD measurement were eight normal subjects (12.9%); 42 osteopenia subjects (67.7%), and 12 osteoporosis subjects (19.4%). The data were analyzed with Fisher's Exact Test. There was a significant relationship ($p < 0.05$) between gender with BMD, and no significant association between periodontal attachment loss with BMD in elderly patients, but there is a tendency of osteopenia on subjects with severe periodontal attachment loss.

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Introduction

Periodontal disease is a major public health problem in several countries. Over 47% (64.7 million) adults, aged 30 years and older, in the United States had periodontitis, distributed as 8.7% mild, 30.0% moderate, and 8.5% severe periodontitis, respectively. For adults aged 65 years and older, 64% had either moderate or severe periodontitis. Eighty-six and 40.9% had 1 (one) or more teeth with clinical attachment loss (CAL) ≥ 3 mm and probing depth (PD) ≥ 4 mm, respectively.¹

Periodontitis and osteoporosis are two independent diseases, represent major health problems all around the world, especially in

elderly population.² These two conditions are related as both damage bone tissue and share common risk factors. The assessment for periodontitis by measurements of alveolar crest height or alveolar bone height, or clinical attachment loss. Some studies found that there was a positive association between periodontitis on the basis of alveolar crest height or alveolar bone height with systemic bone loss, while the other half found no correlation.³ Those studies used clinical attachment loss to assess periodontitis.³ The characterized of periodontitis and osteoporosis increased intensity with age.² The elderly old was age above 45 years old included risk factor.²

A risk factor for periodontitis can be defined as an occurrence or characteristic that has been associated with the increased rate of a subsequently occurring disease.³ According to Van Dyke and Dave, risk factors are associated with a disease but do not cause the disease.³ Risk factors may be modifiable or non-modifiable. Modifiable risk factors are usually environmental or behavioral in nature, whereas non-modifiable

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risk factors or determinant are usually intrinsic to the individual and therefore not easily changed. Osteoporosis included in non-modifiable risk factor.³

Several researcher have supported a possible relationship between periodontitis and osteoporosis, but the relationship unclear, because there were different study design and methods used to assess periodontitis and osteoporosis.⁴ Periodontitis, as a chronic inflammatory disease, which influences the appearance of proinflammatory cytokines through its pathogen bacteria. This condition could be at the same time became the source of osteoporosis.² According to Vishwanath et al.⁵, periodontitis is an inflammatory disease characterized by resorption of the alveolar bone as well as loss of soft tissue attachment to the tooth or periodontal attachment loss, is one of the main causes of tooth loss in adults.

The primary measure of periodontitis in NHANES III was determined by periodontal attachment loss of the soft tissue surrounding the teeth.⁴⁶ Although there are other clinical periodontal parameters included probing depths, bleeding on probing and calculus deposit.⁴ Periodontal attachment loss is a reduction in the connective tissue attaching the root of the tooth to the alveolar bone, usually caused by persistent inflammation of the gingival and periodontal tissues. We can measure the periodontal attachment loss by clinical attachment level of periodontal.

Osteoporosis is a systemic disease, generalized, progressive, and had a condition of the skeletal system characterized by a decrease in bone mass and density.⁴ Osteoporosis results from an imbalance in the rates of bone formation and resorption that cause bones to lose mineral mass. Bone mineral density data were used to classify subjects according to criteria published by the World Health Organization.⁴ Bone densitometry was an instrument with good validity and reliability that can measure the condition of osteoporosis.

Some research suggests a different outcome of the relationship between periodontal condition with osteoporosis in the elderly so that this research will result in the analysis. The aim of this study was to analyze the relationship of periodontal attachment loss and bone mineral density in elderly patients.

Materials and methods

The cross-sectional study in 62 elderly male and female patients, and observational evaluation in aged over 50 years old. The subjects were recruitment in Dental Hospital Universitas Indonesia, Jakarta. The study was approved by the Committee Ethics of Faculty of Dentistry Universitas Indonesia, Jakarta. All volunteers signed an informed consent form.

The inclusion criteria had at least 20 natural teeth on maxilla and mandibula except the third molars, and not yet have any denture. The exclusion criteria were aggressive periodontitis; systemic disease (ex: diabetes mellitus, therapy hormone, and chronic renal failure); being a current or former smoker; initial periodontal treatment within 6 (six) months; a history of any surgical periodontal therapy; and antibiotic, anti-inflammatory, immunosuppressive or cytotoxic drug intake within previous 3 (three) months.

Periodontal conditions were PD and CAL assessed using dental mirrors and a periodontal probe, which was applied at a probing force of 20 g. Periodontal probing at six sites (mesiobuccal, mid-buccal, distobuccal, mesiolingual/palatal, mid-lingual/palatal, and distolingual/palatal) were recorded for all teeth, except the third molars, and rounded to the nearest millimeter. Clinical attachment level was measured from cemento-enamel junction to the bottom of a periodontal pocket. Then it classified into moderate (3-4 mm CAL), and severe (≥ 5 mm of CAL).

Bone ultra sonometer was used to measure bone mineral density (BMD) of calcaneus bone. BMD values were expressed as a T-score (normal > -1.00 ; osteopenia -1.00 to -2.49 ; osteoporosis < -2.5).⁷

The data analyzed with Fisher's Exact Test for showed the distribution of subjects and the association between gender with bone mineral density, so that between periodontal attachment loss with bone mineral density.

Results

Twenty-one male and forty-one female subjects, aged between 50 to 62 years old were participated in this research. There were 7 (seven) subjects (11.3%) of moderate CAL and 55 subjects (88.7%) of severe CAL. The bone

mineral density measurement were eight healthy subjects (12.9%); 42 osteopenia subjects (67.7%), and 12 osteoporosis subjects (19.4%).

Data analyzed with Fisher's Exact Test showed that it was a significant relationship ($p < 0.05$) between gender with BMD (Table 1), and no significant relationship between periodontal attachment loss with BMD in elderly patients (Table 2). Table 2 showed a tendency majority of distribution subjects was osteopenia with severe periodontitis. Table 3 showed that there is no significant association ($p = 0.144$) between gender with periodontal attachment loss. Although, female subjects (62.9%) had severe periodontal attachment loss higher than male subjects.

	Bone Mineral Density (N / %)			Total	p value
	Normal	Osteopenia	Osteoporosis		
Gender					0.006
Male	5 (8.1%)	15 (24.2%)	0 (0.0%)	20 (32.3%)	
Female	3 (4.8%)	27 (43.5%)	12 (19.4%)	42 (67.7%)	
Total	8 (12.9%)	42 (67.7%)	12 (19.4%)	62 (100%)	

Fisher's Exact Test; $p < 0.05$ significant.

Table 1. The Distribution of Subjects and Significantly between Gender with Bone Mineral Density.

	Bone Mineral Density (N / %)			Total	p value
	Normal	Osteopenia	Osteoporosis		
Attachment Loss					1.000
Moderate (3-4 mm)	1 (1.6%)	5 (8.1%)	1 (1.6%)	7 (11.3%)	
Severe (≥ 5 mm)	7 (11.3%)	37 (59.7%)	11 (17.7%)	55 (88.7%)	
Total (N)	8 (12.9%)	42 (67.7%)	12 (19.4%)	62 (100%)	

Fisher's Exact Test; $p < 0.05$ significant.

Table 2. The Distribution of Subjects and Significantly between Periodontal Attachment Loss with Bone Mineral Density.

	Periodontal Attachment Loss (N/%)		Total	p value
	Moderate (3-4 mm)	Severe (≥ 5 mm)		
Gender				0.144
Male	4 (6.5%)	16 (25.8%)	20 (32.3%)	
Female	3 (4.8%)	39 (62.9%)	42 (67.7%)	
Total	7 (11.3%)	55 (88.7%)	62 (100.0%)	

Fisher's Exact Test; $p < 0.05$ significant.

Table 3. The Association between Gender with Periodontal Attachment Loss.

Discussion

The aim of this study was to analyze the relationship of periodontal attachment loss and BMD in elderly patients from Dental Hospital Universitas Indonesia, Jakarta. Sixty-two subjects agree followed in this study.

Osteopenia is a reduction in bone mass

due to an imbalance between bone resorption and formation, resulting in demineralization and leading to osteoporosis.⁸ Osteoporosis is characterized by a decrease in BMD to level below what is required for mechanical support.⁸ Juluri et al. in their study about the correlation of periodontal parameters and bone mineral density showed that osteoporotic women had a significantly greater probing pocket depth, clinical attachment loss, and interproximal alveolar bone loss when compared with the non-osteoporotic women.⁶

Maxillary and mandibular bone mirror skeletal bone conditions. Bone remodeling happens at endosteal surfaces where the osteoclasts and osteoblasts are situated. The bone turnover rate in the mandibular alveolar process is probably the fastest in the body; thus, the first signs of osteoporosis may be revealed here. Hormones, osteoporosis, and aging influence the alveolar process and the skeletal bones similarly, but differences in loading between loaded, half-loaded, and unloaded bones are important to consider. A sparse trabeculation in the mandibular premolar region (large intertrabecular spaces and thin trabeculae) is a reliable sign of osteopenia and a high skeletal fracture risk.⁸

In the aging person, the balance between resorption and deposition becomes negative, because the amount of resorption exceeds the deposition. In the ten years following menopause, women lose close half of their cancellous bone and one-third of their cortical bone mass because of accelerated bone loss from estrogen depletion. In contrast, men lose approximately 30% less bone mass during their lifetime. Once this imbalance has become clinically significant, a person is diagnosed with osteoporosis.⁹

Several studies showed that aging is associated with an increase of periodontal disease.¹⁰ Hebling⁹ has concluded that "The aging process might induce a significant reduction in chemotaxis, mobility, and proliferation rate of periodontal ligament cells. The chemotaxis and differentiation of osteoclasts from the periodontal ligament produced by devitalized osseous matrix might be influenced by donor's age". It has been suggested that the increased level of periodontal destruction observed with aging because of cumulative destruction rather than a result of increased of destruction.

In this study, it was a significant relationship ($p < 0.05$) between gender with BMD (Table 1). The distribution of subjects showed that majority of male and female had osteopenia. This finding similar with other studies in Indonesia.

Table 2 showed that there is no significant relationship between periodontal attachment loss with BMD in elderly patients. The distribution of subjects showed a tendency of osteopenia in moderate and severe periodontal attachment loss. The result of Hernandez study showed the same patterns and periodontitis was detected in 77.1% of females with osteoporosis/osteopenia ($p > 0.05$). A significant correlation was found between osteoporosis and missing teeth.¹¹ Tonguc research showed a significant correlation between the mandibula BMD parameters related to the amount of periodontal destruction.¹² They concluded that low BMD in the jaw may be associated with periodontitis.¹²

Table 3 showed that there is no significant association ($p = 0.144$) between gender with periodontal attachment loss. Although, female subjects (62.9%) had severe periodontal attachment loss higher than male subjects. This finding, agreed with Tonguc study that there was no significant difference between female and male subjects regards to age and mandibular BMD values ($p > 0.01$).¹² In the other results, Phipps et al.¹³ showed the relationship between systemic BMD and periodontal disease progression.

Conclusions

The findings of this study showed a significant relationship between gender with BMD but no relationship between periodontal attachment loss and BMD, but there was a tendency of osteopenia on subjects with severe periodontal attachment loss. There was no significant association between gender with periodontal attachment loss. Although, female subjects had severe periodontal attachment loss higher than male subjects.

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Declaration of Interest

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