

Dental Radiograph Evaluation of the Alveolar Bone in Postmenopausal Women

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Abstract

Osteoporosis, which affects 30% of postmenopausal women, is one of the most significant problems women face during menopause. X-ray examination may be used to evaluate bone quality. The purpose of this cross-sectional study was to evaluate the association between the alveolar bone height and alveolar bone density in postmenopausal women based on a digital periapical radiograph of the mandibular premolar region. The study participants included 76 postmenopausal women. Digora software was used to obtain the mean grey scale value of the region of interest (ROI). The data were analysed using SPSS 23.0. A Mann-Whitney test was used to compare the mean age and duration of osteoporosis. The correlation was analysed using a Pearson test. The results showed no significant differences ($p > .05$) in alveolar bone density in the >5 years postmenopausal women group (71.52 ± 10.28) and the <5 years postmenopausal women group (71.81 ± 13.47). However, a significant correlation between age and alveolar bone loss ($p < .05$), and between age and bone density ($p < .05$) was found. The results indicate that the duration of menopause was not related to the density of the alveolar bone or the reduction of alveolar bone height.

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Introduction

Growth and development during infancy and childhood depend on the mineralization of the skeleton, which achieves peak bone mass during early adulthood. This optimal bone mass varies between women and men. In most women, bone mass reaches its peak in the third decade of life and declines thereafter. This decline in bone mass is accelerated with the onset of menopause and may lead to excessive bone resorption and, ultimately, osteoporosis.¹

Osteoporosis is a disease characterized by low bone mass and micro architectural deterioration it is considered a major health problem that affects 30% of postmenopausal women.² The main complications of this disease are fractures that can cause morbidity, mortality,

and decreased quality of life. An estimated 200 million people have osteoporosis worldwide, and the prevalence increases with the increasing elderly population.³ In the United States, over 10.2 million individuals aged 50 years and over have osteoporosis, and about 43.4 million adults have low bone mass.⁴

X-rays are used to evaluate bone quality. Various studies have demonstrated the manifestation of systemic disease in the jawbone⁵, and bone density can be assessed through dental radiographs, such as panoramic and periapical radiographs. The radiographic examination of bone density has been applied in implantology and in studies assessing the association between bone loss and osteoporosis.⁶

In this study, the authors used a periapical radiograph to evaluate the quality of the participants' alveolar bone. The advantage of a periapical radiograph is the small amount of radiation.^{6,7} The purpose of this study is to evaluate the association between alveolar bone height and alveolar bone density in postmeno-

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pausal women based on digital periapical radiography.

Material and Methods

Seventy-six postmenopausal women aged 50–75 years from Central Jakarta, Indonesia were recruited for this cross-sectional study. All the participants were examined using questionnaires to determine their postmenopausal status. Then, an intraoral digital periapical radiograph was used to evaluate the participants' alveolar bones. The right or left mandibular premolar region was examined using a Photo stimulable Phosphor Plate (PSP) from a Digorasystem.

The exposure conditions included: 60 kVp, 7 mA, and 0.18 second exposure time using the Bel-Ray X-ray apparatus (Belmont, Japan). The PSP directly processed the radiograph to obtain a digital image. The radiograph was evaluated using Digora for Windows software. The height of the alveolar bone was measured from the cement to enamel junction (CEJ) to the alveolar crest, and the bone density was measured in the interproximal area of the premolar. The alveolar density measurement was examined through the marked area in the region of interest (ROI) in the interproximal area of the mandibular

premolars on the right or left side. The grayscale value denoted the value of ROI.⁸

The study's inclusion criteria were postmenopausal women 50–75 years old with their right or left mandibular premolars. Women with any lesions in their mandibular premolars, any systemic disease, and consumption medications were excluded from the study.

The data were analysed using SPSS. Since the data distribution was normal, a Mann-Whitney test was used to compare the mean value of age and the duration of menopause, whereas an independent t-test was used to compare the alveolar bone density and bone height to the duration of osteoporosis. A Pearson correlation test was used to correlate the participants' ages to their alveolar bone density and alveolar bone loss. The value of $p < .05$ was considered significant.

Result

The participants were assessed using a questionnaire to determine their postmenopausal duration. This study was conducted in 76 postmenopausal women. Forty-eight subjects had entered their menopause stage more than five years prior to the study, while the other 28 had entered menopause less than five years prior to the study.

Table 1. Distribution of Age, Alveolar Bone Density, and Alveolar Bone Loss in Postmenopausal Woman

Postmenopausal Woman	Duration of Menopause (Mean (SD))		p value
	> 5 years	< 5 years	
Age (years)	61.98 (7.08)	55.78 (7.07)	0.00*
Alveolar bone density	71.52 (10.28)	71.81 (13.47)	0.18**
Alveolar bone height (mm)	3.96 (1.59)	3.48 (1.31)	0.92**

*Mann-Whitney test; **Independent T-test; $p < .05$ significant difference

The mean age, alveolar bone density, and alveolar bone loss are presented in Table 1. The Mann-Whitney test was performed to compare the age between the groups, while an independent T-test was used to compare the alveolar bone density and alveolar bone height to the duration of menopause. No difference in mean alveolar bone density and alveolar bone height to the duration of menopause was found.

Table 2. Correlation between the Radiograph Assessment and Age of Postmenopausal Woman.

Radiograph Assessment	Age of Postmenopausal Woman	p value	R
Alveolar bone density	bone	0.00	0.25
Alveolar bone height	bone	0.01	0.28

Pearson test; $p < .05$ significant

Since the data was normal, a Pearson correlation test was used to analyse the correlation between age and alveolar bone density and alveolar bone height. Table 2 shows a negative correlation between age and alveolar bone density ($p=.00$) and alveolar bone height ($p=.01$).

Discussion

This study assessed the relationship between alveolar bone changes in postmenopausal women based on digital periapical radiographs. The results showed that the association between alveolar bone changes and the duration of menopause was not significant.

Menopause is associated with oestrogen deficiency, which causes changes in the periodontium, such as xerostomia, burning sensations in the oral mucosa, bleeding on probing, and alveolar bone loss.⁹ Our results indicate a negative correlation between duration of menopause with alveolar density and alveolar bone loss.

The biological changes on the periodontal tissues during time points, such as puberty, the menstrual cycle, pregnancy, menopause, and oral contraceptive use, increase the relationship between steroid sex hormones and the health of the periodontium.⁹ As women approach menopause, their oestrogen levels begin drop, mainly during the late follicular and luteal phase of the menstrual cycle.^{10,11} Oestrogen deficiency during menopause may cause bone loss and is one of the most frequent causes of osteoporosis in women. Oestrogen plays an important role in the growth and maturation of bone as well in the regulation of bone turnover in adult bone.¹² Oestrogen inhibits the expression of inflammatory cytokines that are important in bone resorption, and oestrogen deficiency may contribute to bone both oral and skeletal loss.⁹

In this study, the duration of menopause was not related to the alveolar bone loss or density. Amadei et al. found that duration of oestrogen deficiency did not affect the alveolar bone amount.¹³ Anbinder et al. found that oestrogen deficiency could not be considered a risk factor for periodontal disease. The influence of oestrogen deficiency on alveolar bone loss in animal and human studies show conflicting

result. Moriya et al. evaluated the alveolar bone loss in ovariectomized rats and concluded that osteoporosis itself would not be capable of causing periodontal disease.¹⁴

Alveolar bone loss increase and bone density decrease, as a biologic phenomenon, with the advancement of age.¹⁵ In the current study, age has a significant correlation with alveolar bone loss and density. These findings are consistent with Albandar et al., who found that the loss of bone density in healthy individuals began at age 35 and progressively declined to age 85. These data suggest that alveolar bone is more likely a sequel of systemic factors relating to aging and cannot be prevented through oral hygiene practice.¹⁶

Conclusion

The results of this study indicate that the duration of menopause is not related to the density of the alveolar bone or to the alveolar bone loss. However, a correlation between age and alveolar bone density and loss was found. The digital periapical radiograph can be used to measure the alveolar bone density because digital periapical radiograph is easy, convenient, cost effective, and routinely used by dentists.

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Declaration of Interest

The author declare no conflict of interest.

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