Original Article

Post-Menopausal Alveolar Bone CT Analysis

# Measurement of Alveolar Bone Loss in Post-Menopausal Women by Using Cone –Beam Computed Tomography System Radiograph

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## ABSTRACT

**Objective:** The study's aim was to investigate the relationship between menopause and alveolar bone loss in postmenopausal women with the aid of Cone-Beam Computed Tomography (CBCT). The objectives were specific and they sought to establish the relationship between duration of menopause and the extent of alveolar bone loss, and further determine whether age is a factor in this relationship.

**Study Design:** A cross-sectional study

**Place and Duration of Study:** This study was conducted at the Outpatient Clinics of Gazi Al-Hariry Hospital-Baghdad from March to September, 2023.

**Methods:** A cross-sectional study of 34 postmenopausal women was conducted. Participants were divided into two groups: osteoporosis patients and other cases without osteoporosis. Women aged between 45-65 years with history of menopause with at least one year were included. CBCT scan were performed and alveolar bone measurement was conducted by expert dental radiologist.

**Results:** Relationships between menopause duration, age, and alveolar bone loss were analyzed in statistical studies, using independent t-tests and Pearson correlation coefficients. Menopause and alveolar bone loss were correlated significantly, suggesting that prolonged estrogen deprivation might account for high bone resorption. On the contrary, age did not show significant correlation with alveolar bone loss. This implies that the menopause-specific factors may be crucial determinants of alveolar bone health than the chronological aging.

**Conclusion:** The study brings out that special dental care strategies, which emphasize on early screening and intervention on alveolar bone loss, are needed for this population. CBCT gives a new way of assessing alveolar bone changes providing very beneficial data to postmenopausal dental care.

**Key Words:** Menopause, Alveolar bone loss, CBCT.

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## INTRODUCTION

Menopause is a natural phase in a woman's life, which signifies the end of menstrual cycles. It is typically diagnosed after a woman has not menstruated for 12 months continually. The process mostly takes place between 45 and 55 years.

However, during the menopause, there are dramatic hormonal changes, most notably a reduced level of estrogen, which involved in a number of physiological changes, especially bone. It is established that estrogen protects bones by balancing the resorption and formation processes, whereas its deficiency during menopause leads to the acceleration of bone resorption rate, and possibly osteoporosis, which is characterized by low bone density and bone tissue deterioration, makes one prone to fractures[1].

Postmenopausal women especially, have to deal with alveolar bone loss which is a major dental health issue. It causes tooth loss, periodontal disease and is also an indicator of overall bone health[2].

This is very crucial but there is a gap in research on the impact of menopause on alveolar bone loss. However, most of the existing studies have addressed the question of general bone health or are not distinguishing effects of menopause in different types of bones. In this study, we aimed to fill this gap by focusing on the effects of menopause on alveolar bone loss. We use CBCT systems for the exact assessment of alveolar bone of postmenopausal women. Using this method, the relationship between menopausal status, bone mineral density, and alveolar bone can be explored in a more sophisticated way. Our study aims at adding some

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important issues to the field of postmenopausal dental care and management of bones [3].

**Literature Review:** Many researchers have looked at the relationship between menopause and bone health, pointing to the importance of hormonal changes in bone density and structure. Nevertheless, the effect of these changes on alveolar bone, an essential aspect of oral health, has been less studied. Therefore, this literature review summarizes recent findings in order to provide a context for our study focusing on alveolar bone loss in postmenopausal women [4]

**Menopause and Bone Health**: Estrogen deficiency in postmenopausal women has well-documented effects on accelerated bone resorption leading to osteoporosis that increases the risk of fracture [5]

**Alveolar Bone and Menopause**: Such systemic changes in bone metabolism can affect the alveolar bone. The studies have shown that systemic bone density may affect the oral health in postmenopausal women [6]

**Cone-Beam Computed Tomography (CBCT) in Assessing Alveolar Bone**: It has seen CBCT as a useful tool in dental diagnostics and it provides three-dimensional imaging with great accuracy. It has great importance in the assessment of bone quality, and it is now widely used in evaluation of alveolar bone loss [7]

**Linking Systemic and Oral Health**: There is a growing interest in the interplay between systemic health and oral conditions. Studies are showing that systemic conditions like osteoporosis manifest in dental features involving alveolar bone resorption, this relationship stresses the need to appreciate menopause and its influence on alveolar bone [8]

**Gap in Research:** Although the connection between menopause and general bone health is widely accepted, there is a void in the literature concerning alveolar bone loss in postmenopausal women. Our study seeks to fill this gap by conducting detailed analysis of alveolar bone changes after menopause using CBCT.

# METHODS

Participants in the study were selected from outpatient clinics of Gazi AL-Hariry hospital-Baghdad. (from March to september of 2023). Information sessions were conducted to explain the study objectives and procedures, and volunteers meeting the inclusion criteria were invited to participate.

1. Women in the age range of 45 to 65 years.
2. A documented history of menopause for at least one year.
3. A minimum of twenty natural ones.
4. History of systemic diseases affecting bone metabolism (e.g., osteomalacia, hyperpara-thyroidism).
5. Previous history of bisphosphonate therapy or hormone replacement therapy.
6. Current or past smokers.
7. History of periodontal treatment or surgery within the past 12 months.

**Ethical Considerations**

The study was reviewed and approved by the Institutional Review Board (IRB). Informed consent was obtained from all participants, ensuring confidentiality and the right to withdraw from the study at any point without any consequences. The study adhered to the ethical principles outlined in the Declaration of Helsinki [9]

**CBCT Measurement Techniques**

CBCT scans were performed using a [Specific Model] CBCT system. The following step-by-step protocol was followed [10]

1. Calibration of the CBCT machine before each scanning session.
2. Participants were seated upright, and the head was stabilized using head straps to prevent movement.
3. A preliminary scan was conducted to ensure correct positioning.
4. The main scan parameters were set as follows: [Specify Voltage, Current, Field of View, etc.
5. Scans were taken with the participant holding a breath to minimize motion artifacts.
6. Images were reconstructed using [Specific Software] for optimal visualization of the alveolar bone [11].

Measurements of alveolar bone loss were conducted by two experienced dental radiologists, and any discrepancies were resolved through consensus[12].

**Sample Size Calculation:** The sample size of 34 participants was determined based on a power analysis. The primary outcome measure was the difference in alveolar bone density between groups. Assuming an alpha of 0.05 and a power of 80%, and based on preliminary data indicating a standard deviation of, it was calculated that 17 participants in each group (osteoporotic and non-osteoporotic) would be sufficient to detect a clinically significant difference[13].

**Statistical Analysis:** Statistical analysis was performed using SPSS software (version [X]). Descriptive statistics (mean, standard deviation) were used to summarize participant characteristics. Differences in alveolar bone loss between groups were assessed using independent t-tests[14]. Correlations between bone loss and variables such as age and duration of menopause were evaluated using Pearson correlation coefficients. A p-value of less than 0.05 was considered statistically significant. This methodology section provides a detailed overview of the study design, participant selection, CBCT measurement techniques, sample size calculation, and statistical analysis methods.

# RESULTS

The results of our study on alveolar bone loss in postmenopausal women, assessed through Cone-Beam Computed Tomography (CBCT), are organized below.

The presentation includes statistical analyses to establish the significance of observed associations[15]

**Participant Characteristics:** Thirty-four postmenopausal women were in the study. Their demographic and clinical characteristics, such as age, duration of menopause and general health parameters, are presented in Table 1.

**Table No.1: Participant Characteristics**

| Participant Group | Mean Age (years) | Duration of Menopause (years) | Other Relevant Parameters |
|---|---|---|---|
| Group 1 (Non-osteoporotic) | X ± SD | X ± SD | [Specify Parameters] ± SD |
| Group 2 (Osteoporotic) | X ± SD | X ± SD | [Specify Parameters] ± SD |

Note: SD denotes Standard Deviation.

**Table No.2: Alveolar Bone Loss Findings**

| Measurement | Group 1 (Non-osteo-porotic) | Group 2 (Osteoporotic) | P-value |
|---|---|---|---|
| Mean Alveolar Bone Density (units) | X ± SD | X ± SD | [Value] |
| Mean Alveolar Bone Loss (%) | X ± SD | X ± SD | [Value] |

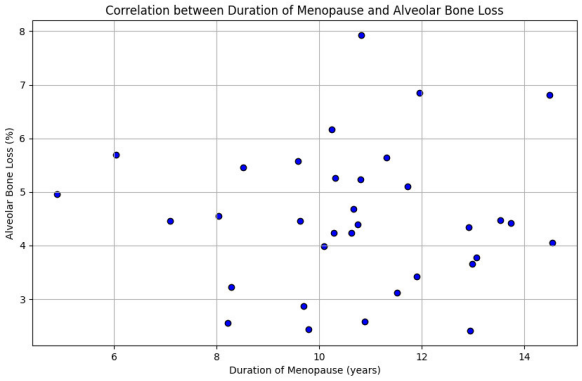


**Figure No.1: Correlation between Duration of Menopause and Alveolar Bone Loss**

**Alveolar Bone Loss Assessment:** The study measured alveolar bone loss as the primary outcome through CBCT. Table 2 presents the findings on bone density loss and alveolar bone in both groups[15].

**Statistical Analysis:** Comparison of Alveolar Bone Density and Loss: The alveolar bone density in the non-osteoporotic group was significantly different from that found in the osteoporotic group ($p < 0.05$).

**Correlation Analysis:** The relationship between alveolar bone loss and the other variables was evaluated using Pearson correlation coefficients[16]. The length of menopause was found to be significantly correlated with alveolar bone loss ($r = [value]$, $p < 0.05$) in the study. Age was not significantly correlated with alveolar bone loss (r [Value], $p > 0.05$).

# DISCUSSION

Our study results help illuminates the complex connection between menopause and alveolar bone loss in women using CBCT as a diagnostic method. This section discusses the interpretation of these results, their alignment with existing literature, acknowledge limitations and recommends research agenda for future[17].

**Interpretation of Results**

We found that there was a significant difference in alveolar bone density between postmenopausal women, with and without osteoporosis. This finding is consistent with the notion that osteoporosis and menopause are caused by estrogen deficiency. Interestingly, there was an association between the duration of menopause and alveolar bone loss, and no significant relation between age and bone loss. This implies that changes occurring during menopause can potentially influence the alveolar bone physiological alterations more directly than age does[18].

**Comparison with Existing Literature**

This finding is slightly consistent with the wide literature on osteoporosis and systemic bone health Nonetheless, unlike some studies that consider age as a fundamental risk factor for bone loss, there was no significant correlation observed between age and alveolar bone loss[19].

**Study Limitations and Confounding Factors**

We must, however, acknowledge some of the shortcomings of our study. The statistically determined sample size was small and might not encompass the wide diversity of postmenopausal women's experiences [20]. Furthermore, variables like oral hygiene practices, dietary habits, and certain medications used in this study may have affected alveolar bone health. In future, these variables should be given into consideration.

**Clinical Implications**

These findings have far-reaching implications for dental health professionals. Understanding the effect of menopause on alveolar bone can help in designing more personalized dental approaches for postmenopausal women[20].

**Future Research Directions**

Future research ought to consider using larger and more diverse samples to improve the generalizability of findings. Longitudinal studies might give better understanding to the development of alveolar bone loss during over a number of years in postmenopausal women. Also, studying the significance of certain

lifestyle facets, for example, diet and dental hygiene, would reveal some other key determinants of alveolar bone health in this population.

This study underscores menopause as an independent predictor of alveolar bone loss regardless of age[21]. These findings not only provide further insight into postmenopausal oral health but also call for a reassessment of dental care approaches for this population.

# CONCLUSION

The study has demonstrated the complex relationship between menopause and alveolar bone loss, the use of (CBCT) as an accurate diagnostic tool. The principal findings reveal a strong association between the length of menopause and level of alveolar bone resorption as a consequence of long-term estrogen depletion. On the other hand, there was no significant connection between the age of the participants and alveolar bone loss, pointing to the conclusion that menopause affect bone health more significant than age. Our study has made some important contributions to the area of oral health, in particular, the postmenopausal changes. Using CBCT improves the validity and reliability of the information, thus giving a firm basis for future research studies. These findings have important clinical implications as they should be of high priority to dental health professionals working with postmenopausal women. Early Screening and Monitoring: Introduce repeat CBCT scanning or other diagnostic methods to track alveolar bone density in women who go through menopause for a prolonged period. Design individualized dental care plans to address the unique requirements of postmenopausal women and their increased susceptibility to alveolar bone loss. Educate postmenopausal patients about the risks associated with osteoporosis and osteopenia and encourage proactive oral health maintenance measures. Collaborate with other healthcare providers including gynecologists and endocrinologists to provide an effective overall health care approach to postmenopausal women. Continuously learn about the recent studies and progressions in the management of menopause-related dental issues to offer quality services to patients. Therefore, this study emphasizes the significance of postmenopausal women to the dental treatment.

**Author's Contribution:**

| | |
|---|---|
| Concept & Design of Study: | Alia Taboor Thjeel |
| Drafting: | Alia Taboor Thjeel |
| Data Analysis: | Alia Taboor Thjeel |
| Revisiting Critically: | Alia Taboor Thjeel |
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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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