

## The periodontal health status of postmenopausal women and its relationship to bone mineral density

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### Abstract:

The relationship between changes in postmenopausal women and periodontal condition had been studied in many countries. It has been suggested that estrogen deficiency may play a role in periodontal disease following menopause. The aim of this study was to investigate the influence of postmenopausal alteration on the clinical periodontal parameters and teeth loss. In addition, to determine the relationship between systemic bone mineral density and periodontal disease in postmenopausal women.

Sixty Iraqi women in total were involved in this study, 20 women as a control group of age (35-45) years and forty postmenopausal women divided into two subgroups: group 1 for age (50-60) years and group 2 of age (60-70) years. Questionnaire involved the following periodontal parameters:

Plaque index (PI), gingival index (GI), bleeding on probing (BOP), pocket depth (PD), clinical attachment level (CAL). All these parameters were measured and tabulated according to redefined scores, or counts, and the data was analyzed statistically.

Fifteen of forty postmenopausal women, were examined using dual energy x-ray absorptiometry (DEXA) equipment to measure bone mineral density (BMD) in order to determine the relationship between (BMD) and any of the above periodontal parameters. The means, GI, BOP, PD and CAL were found to be significantly higher in the postmenopausal group than the control ( $P < 0.05$ ).

It was found that BMD is negatively associated with GI, BOP, PD and CAL but the correlation is either of high significant or of slight of difference but not significant at ( $P < 0.05$ ). The clinical parameters may increase depending on the expected negative effects during menopause further, it is concluded that BMD of the lumbar spine is related to CAL, PD, number of teeth loss and to a lesser extent BOP.

### Keywords:

Periodontal health status, postmenopausal women, bone mineral densities.

### Introduction:

The role of systemic conditions and disorders proposed to play a role in periodontal disease<sup>(1)</sup>, and there are many factors known or suspected to influence periodontal disease occurrence and or severity; one of

these factors is systemic hormone changes, female sex hormones in particular have been implicated, and several studies have linked hormonally-determined states to increase gingival inflammation.<sup>(2,3)</sup>

The known median age of menopause is 50 years and 1/3 of an

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average women's life time is postmenopausal <sup>(4)</sup> and during this period, the productions of female sex hormones change drastically as a result of decreasing ovarian function <sup>(5,6)</sup>. It has been speculated that estrogen deficiency may play a role in the progression of the periodontal disease following menopause <sup>(7)</sup>, however limited data exist correlating the effects of menopause with the periodontal parameters.

A lot of research has been well established that bone loss is influenced by both systemic and local factors <sup>(8)</sup>. There is biological plausibility that at least part of the periodontal destruction is influenced by systemic bone loss <sup>(9)</sup> also lowered bone mineral density contribute to periodontal tissue breakdown.

Many interesting results in different researches in general agree on the influence of postmenopausal alterations on the clinical periodontal measurements and the existence of the relationship between some clinical measurements and bone density; but such relationship is variable from one study to another.

The aim of this study was to determine the post menopausal health status of the periodontium and the magnitude of systemic bone mineral density in relation to periodontal health.

## Materials and methods:

### 1. Materials

-Human sample

Sixty women attending the College of Dentistry /University

of Baghdad or Al- Karama specialized center for dentistry were examined in this study, their age ranged (35-70) years.

These subjects were divided into two major groups, one control and another for postmenopausal major group:

**Postmenopausal group:** 40 postmenopausal women who were divided into two subgroups according to age:

**Group 1 (PG1):** 20 postmenopausal women within at least 5 years of menopause, age range (50 – 60) years.

**Group 2 (PG2):** 20 postmenopausal women within at least 15 years of menopause, age range (60-70) years.

**Control group (CG):** 20 women represent the control group who were undergoing normal menstrual cycle age range (35-45) years.

All subjects were healthy with no history of systemic disease or under medication.

### 2. Methods

All subjects answered a written questionnaire case sheet regarding their dental and medical histories, and their socioeconomic status.

#### Oral examination and indices

The oral examination was carried out for all teeth excluding the third molars. The parameters used in the periodontal assessment are the following: -

- Plaque index (PLI) <sup>(10)</sup>
- Gingival index (GI) <sup>(11)</sup>
- Probing pocket depth (PPD).
- Bleeding on probing (BOP).
- Clinical attachment level (CAL).

Scale: the CAL measurement in (mm)

	Scale				
	0	1	2	3	4
AL in (mm)	0	1-3	4-6	7-9	≥10

**-Dual energy x – ray absorptiometry system: this included:**

- Exam table
- Smart scan auto positioning
- Automated quality control
- En CORE 2002 software GE Medical System LUNAR.

**Skeletal bone mineral density scan**

Dual energy x –ray absorptiometry is a quantitative imaging technique that uses an x – radiation source to measure BMD which is measurement of bone mineral found in the region of interest <sup>(12)</sup>. BMD is measured in grams per centimeter squared. BMD is derived using bone mineral content BMC divided by area, where BMC is measured in grams and area is measured in centimeters squared. We were referred by bone specialists to use this new equipment which was recently brought into Iraq and installed in the x –ray institute. We succeeded to get approval to use it as many as (15) patients to measure BMD at the lumber spine (antero-posterior) for L1-L2-L3-L4 to calculate the BMD mean lumber spine.

**1. Measuring BMD:**

The manner used for measuring BMD by DEXA according to encore operator's manual includes easurement procedure.

There are 5 basic steps necessary to complete patient measurement:

**Step 1:** Record new patient information.

**Step 2:** Select measurement site.

**Step 3:** Position patient.

The graphics that follow to position the patient for a specific measurement site have been used so far Antro-posterior AP spine measurement the support block used to elevate the patient's legs. Patient's thighs form a 60<sup>0</sup>-90<sup>0</sup> angle with the table top.

**Step 4:** Adjust measurement start position.

**Step 5:** Start measurement

**2. Basic analysis procedure**

Basic steps for images analysis are:

**Step1:** Select image In the image list, the image wanted to analyze selected and then the analyze screen is shown.

**Step 2:** A djust image. The imaging selected from the analyzed tool bar to adjust the image: the image tool window is shown. This window used to change the gray levels of the image and magnify it.

**Step3:** examine region of interest (ROI) position.

**3. Examine results**

Graph examined and analysis reports created by the results tab at the analyze screen.

**-Reference graph and table**

The reference graph viewed the standard deviation (SD) for the patient's measurement graphically. The SD is given in BMD (g/cm<sup>2</sup>).

**-Create results report**

Report selected from analyze toolbar. Then OK selected to create the results report.

**Statistical Analysis**

Both descriptive and inferential statistical methods are used to analyze the collected data. Since the readings originally was measured in millimeters and recorded as frequencies of observed in scores 0,1,2,3, and 4 for PI, GI and CAL, where BOP and PD are classified either 0 or 1. These frequency and distribution are done for all four surfaces of each tooth. Well known statistical tests were used

to infer whether there are significant differences or relationships at  $P < 0.05$  level of significance. Tests such as t-test, chi-square, ANOVA tests and  $r$ -test for the correlation coefficients were used.

## Results:

The weighted averages calculated for each woman and for each parameter and the general means and standard deviations (SD) for each one of parameter were calculated.

### Plaque Index (PI)

The mean score for postmenopausal women in general ( $1.41 \pm 0.07$ ) and for the control group is ( $1.22 \pm 0.07$ ) no significant value ( $P < 0.05$ ) was found.

The mean score is higher in PG2 than PG1. No significant difference between different groups ( $P > 0.05$ ), (Table 1, 2 and 5).

### Gingival index (GI)

The general mean score of GI in postmenopausal women is ( $0.96 \pm 0.09$ ), in PG1 group ( $0.83 \pm 0.12$ ), while it is ( $1.09 \pm 0.13$ ) for PG2, and ( $0.47 \pm 0.05$ ) for the control group. It was shown significant difference among the three groups at  $P < 0.05$ . (Table 1, 2 and 5).

### Bleeding on probing (BOP)

Total mean for postmenopausal group is ( $0.55 \pm 0.04$ ) while for control group is ( $0.21 \pm 0.03$ ), t-test show

highly significant ( $P < 0.05$ ). A significant value of the existence of a differences among the three groups was obtained (Table 1, 2, and 3).

### Pocket depth (PD)

The scales used to represent pocket depth are 0 to represent no presence of pocket, or if PD is  $> 4$ mm scale of 1 is given. A highly significance among the three groups has found ( $P < 0.0001$ ) (Table 1, 2 and 4).

### Attachment loss (AL)

It is obvious to see an increase in the average CAL on control group, the value was ( $0.24 \pm 0.05$ ). PG1 showed ( $0.84 \pm 0.15$ ) and to PG2 was ( $1.3 \pm 0.16$ ). A high significant difference exists among the three groups. ( $P < 0.05$ ) but there is no significant difference between PG1 and PG2 ( $P > 0.05$ ). (Table 1, 2 and 5).

### Teeth loss

The number of teeth lost was represented in Table (6), the PG2 showed that highest percentage loss of 60% simple Z-tests among the three groups emphasized the high significant difference between control vs PG1 and control vs PG2 at  $P < 0.05$ .

### Bone mineral density (BMD)

Table (7) shows that parameter's means, and the range of the (15) postmenopausal women who went under x-ray tests using DEXA apparatus to measure their BMD.

The coefficient of correlations was calculated between the BMD and each of the five clinical indices and measurements using the (15) joint observations. A statistical test of significant is used to test each of the values of the correlation. The results shows that there are negative

correlation between BMD and each of GI, BOP, PD and CAL measures except for PI is almost no correlation ( $r=0.022$ ). The correlation of BMD with teeth loss is negative and significant at ( $P<0.05$ ) that is when BMD decrease the teeth loss increase significantly (Table 8).

**Table (8):** Correlation coefficients of BMD with the periodontal parameters and their level of significant differences.

BMD	PI	GI	BOP	PD	CAL	No. of missing
r	0.022	-0.348	-0.454	-0.671	-0.699	-0.610
p.value	0.939	0.204	0.089	0.006	0.004	0.016
Sig.	NS	NS	NS	HS	HS	S

## Discussion:

The results of this study confirmed many points made by some researchers but we concluded some new results which emphasized the significant relations of the bone density and some of the periodontal parameters.

The present study had shown that the differences in plaque accumulation were not of a significant importance among all groups. These finding agree with Cekici et al.,<sup>(13)</sup> and Yalcin et al.,<sup>(14)</sup>. Tenovuo and Laine<sup>(15)</sup>, Kimura et al.<sup>(16)</sup>, Concluded that the decrease in the concentration of circulating estrogens in postmenopausal women may result in an increase in the plaque index.

In this investigation more gingival inflammation was observed in postmenopausal group compared with control group, this confirms the results obtained by Cekici et al.<sup>(13)</sup> and Yacin et al.<sup>(14)</sup>. A possible explanation of this result as extracted from the questionnaire case sheet that Iraqi women in the first decade of menopause (PG1) had higher frequency of brushing than older women (PG2), also reduction of bone

mineral density, which increases with age<sup>(17)</sup> that affects tooth stability and end with less dental care.

Regarding BOP, this study came with a result that there is a high significant difference existing between groups and the frequency distribution show high percentage of score (0) in the control group and highly percentage of score (1) in PG2, this may be attributed to hormonal changes that exaggerated the response to dental plaque. This results agrees with Reinhardt et al.<sup>(18)</sup>.

Pocket depth investigation demonstrated a highly significant difference between control and postmenopausal groups and this is in agreement with Inagaki et al.<sup>(19)</sup>. This gives indication that postmenopausal period may be associated with periodontal breakdown, and estrogen deficiency may play a role in the progression of periodontal disease and alveolar bone loss since estrogen is believed to be involved in the synthesis and maintenance of collagen, also it has been speculated that level of PGE2 in the gingival cervical fluid may increase during menopause and that accompanying an increase in probing depth<sup>(20,21)</sup>.

This study revealed that CAL was significantly changed between control and postmenopausal groups and this agree with Cekici et al.<sup>(13)</sup>, Charles et al.<sup>(20)</sup>. Numerous studies have reported a high prevalence and severity of periodontal disease with increasing age<sup>(22,23)</sup>. In a study by Grossi et al.<sup>(24)</sup>, age had emerged as the single variable most strongly associated with attachment loss.

Our investigation demonstrated that high percentage of tooth loss occur in PG2 while less percentage was in control group. The importance of having large number of missing teeth in postmenopausal women seems to be related to bone mineral density and total body calcium and this agree with Krall et al.<sup>(25)</sup> Kribbs and Chsnut<sup>(26)</sup>.

The results have showed a negative correlation of BMD with most periodontal parameters (G1, BOP, PD, CAL and teeth loss) with except for PI, which showed no association. PD and GAL showed a high significant correlation with BMD at  $P=0.006$  and  $P=0.004$  respectively, whereas the number of missing teeth was significantly correlated with BMD at  $P=0.016$ . Kim et al.<sup>(27)</sup> succeeded to establish a significant relation of PD, AL and BMD at  $P<0.01$ ,  $P<0.01$  respectively. These results suggest that the lowered bone mineral density could contribute to the periodontal tissue breakdown in postmenopausal women. These findings agree with our results. Mine et al.<sup>(9)</sup>, VonWomern et al.<sup>(28)</sup> concluded that skeletal BMD is related to CAL, implicating postmenopausal osteopenia as a risk indicator for periodontal disease in postmenopausal women. On the other hand Pilgram<sup>(21)</sup>, Lee et al.<sup>(29)</sup>, Weyant et al.<sup>(30)</sup> failed to establish a define correlation between BMD and CAL. Others like May et al.<sup>(31)</sup>, Klemetti et al.<sup>(32)</sup> showed no relationship between systemic BMD

and number of teeth, but Famili and Cautey<sup>(33)</sup> found little evidence of association between edentulousness and changes in BMD. In our study, we found a significant relationship between BMD and number of teeth lost, Taguchi et al.<sup>(34)</sup>, Kirall et al.<sup>(35)</sup> Inagaki et al.<sup>(19)</sup> reported a similar results. Jeffcoat<sup>(36)</sup> made a review of the work done on the risk factors for osteoporosis and periodontiti, he concluded that systemic BMD was associated with an increased risk of additional tooth loss.

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