# GINGIVAL RECESSION IN POSTMENOPAUSAL WOMEN WITH AND WITHOUT OSTEOPOROSIS

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**Abstract**

***Background.*** *The periodontal disease is a complex chronic progressive inflammatory and destructive process of the tooth attachment apparatus: gingiva, alveolar bone, desmodontium, cementum. Systemic osteoporosis has a potential influence on both the periodontal and gingival inflammation indices, on the gingival recession (GR) and teeth mobility.*

***The aim*** *of this study was to investigate the possible relationship between the menopause osteoporosis and gingival recession, by studying the correlations between osteoporosis and gingival recession, and between the bone mineral density (BMD) at the level of L1-L4, femur, hip, mandible and gum recession.*

***Materials and methods.*** *The present study included a total of 97 postmenopausal patients. The diagnosis of osteoporosis was made based on the WHO definition. The results were expressed as absolute BMD values in g/cm$^2$ and as T score form. We used dual x-ray absortiometry (DXA) measurements in assessing the lumbar column, proximal femur and mandible and we calculated the T scores. The gingival recession, which is an indicator of ligament tissue lysis and apical migration of the periodontal tissue, was measured as the distance between the anatomical tooth neck and the gumline. For the statistical analysis the Medcalc program version 12.3 was used.*

***Results.*** *We found statistically significant differences between the two groups of women, with and without osteoporosis, in terms of the distribution of the cases of GR (p=0.003). The only parameter with statistical significance of the differences between the three categories of gingival recessions (absent, moderate, major), was p=0.034 for the femoral neck BMD. There were significant differences between the mean values of lumbar column L1-L4 BMD according to the presence or absence of recession signs.*

***Conclusions.*** *1) The prevalence of moderate and major gingival recession was statistically significantly higher in the group of postmenopausal women with osteoporosis. 2) In postmenopausal women, statistically significant differences were found between the femoral neck BMD values according to the three types of gingival recession. 3) The mean L1-L4 BMD values and the femoral neck BMD were significantly lower in the women with GR compared to those without gingival recession.*

**Keywords:** gingival recession, postmenopausal osteoporosis.

## Introduction

The periodontal disease is defined as a complex chronic progressive inflammatory and destructive process, affecting one, several or all four components of the tooth attachment apparatus: gingiva, alveolar bone, desmodontium, cementum.

Osteoporosis is a disease characterized by compromised bone strength, predisposing to an increased fracture risk [1]. Studies in literature show a potential influence of the systemic osteoporosis both on the periodontal and gingival inflammation indices and on the gingival recession and teeth mobility.

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## Working hypothesis

Osteoporosis is a widespread bone disease, which can also be found in the dento-maxillary bone tissue as highlighted in literature. The marginal periodontium condition, which is a widespread pathology with a complex etiopathogenesis, is still poorly understood. The studies published in literature about the possible implication of osteoporosis in the marginal periodontium condition are few, contradictory and sometimes inconclusive.

Taking into account all the above data, as well as certain clinical practice observations with regard to the influence of osteoporosis on the relatively high prevalence of GR, the present paper shows the relations of interdependence between these variables.

The aim of this study was to research the possible relationship between the menopause osteoporosis and gingival recession. We intended to study the correlations between:

- Osteoporosis and GR
- Bone mineral density (BMD) at the level of L1-L4, femur, hip, mandible and GR.

## Patients and methods

The present study included a total of 97 post-menopausal patients, aged between 47 and 76 years, who were recorded at the Endocrinology Clinic of Cluj-Napoca in the period 2006-2008. They were divided into 2 groups: a group with osteoporosis - 62 patients with a mean age of 62.42±7.852 years and a control group without osteoporosis - 35 patients with a mean age of 56.80±7.003 years.

Menopause was considered as the discontinuation of menstruation as a result of the loss of ovarian activity.

The diagnosis of osteoporosis was made based on the WHO definition and BMD, which compares an individual's bone density with standard values in a population aged 20-40 years of the same sex and race and expresses it as a number of standard deviations from the average.

The results were expressed as absolute BMD values in g/cm$^2$ and as T score, in the case of the lumbar column and proximal femur. The latter related the BMD of the studied subject to the ideal maximum bone capital, namely: the BMD of a young subject of the same sex and race.

As a consequence, the formula applied in determining the T score was:

$$\frac{[\text{BMD (g/cm}^2\text{) patient}] - [\text{BMD (g/cm}^2\text{) young adult}]}{\text{standard deviation (SD)}}$$

As there is no national reference population to which the results could be related after the dual x-ray absortiometry (DXA) measurement, when calculating the T scores, the data from the NHANES (National Health and Nutrition Examination Survey) III were taken into account.

The density of the osteoporotic bone tissue was 2.5 SD below the mean value (T-score <-2.5). Osteopenic tissue had a T-score between -2.5 and -1. Normal bones have a BMD T-score of -1 or higher [2].

The regions of interest taken into consideration in the study group were the lumbar column (L1-L4 segment), proximal femur (the femoral neck, trochanter and total hip) and mandible.

The measurement of the vertebral column was performed on the patient in supine position with both legs raised to about 80-90˚ from the body, knees bent and supported on a special stand. This position ensures the attenuation of physiological lumbar lordosis and allows optimal assessment of the L1-L4 region.

The hip assessment was also performed with the patient in supine position with the legs slightly apart and rotated to the inside.

The lumbar column and hip analysis for the evaluated regions was performed automatically with the specific software - for the spine and hip - of the DPX-NT machine.

In assessing the mandible, the patient was positioned with the cephalic extremity rotated to the left and with the mouth wide open.

For the mandibular DXA, because at present there is no specific evaluation software version for this region, the distal forearm software procedures were used and further analysis was performed by manually defining the mandibular bone contour in each case. The amount of bone mineral tissue obtained was related to the measured area, and thus the mandibular bone density (g/cm$^2$) resulted [2].

The gingival recession, which is an indicator of ligament tissue lysis and apical migration of the periodontal tissue, was measured as the distance between the anatomical tooth neck and the gumline [3,4]. The GR may be of various degrees - from mild recession visible in the front, up to the root furcation exposure in the more severe cases. Therefore, the GR was classified as: absent, moderate and major. Each patient was given a study sheet in which the personal details, results of the clinical examination and data of the DEXA exploration were recorded. All the patients were informed about the purpose of the study and their consent was obtained.

The study was analytical, transversal, observational and case-controlled.

For the statistical analysis the Medcalc program version 12.3 was used.

The findings were labeled as nominal, ordinal, dichotomous and continuous variables. The normality of the distribution of continuous variables was tested by the Kolmogorov-Smirnov test. To describe the variables with normal distribution, the mean ± standard deviation was calculated. For the univariate analysis of the variables with normal distribution we used the t test for independent variables (for dichotomous variables), Pearson correlation (for continuous variables) and ANOVA test (for nominal

variables). For the analysis of ordinal variables the Spearman's Rho correlation was used. As statistical significance threshold, we set the parameter p at 0.05.

## Results

**Table I.** Gingival recession in the two groups of postmenopausal women: with and without osteoporosis.

| | | Retractions | | | p |
|---|---|---|---|---|---|
| | | without | major | moderate | |
| Group | M | 10 | 8 | 15 | 0.003 |
| | OP | 3 | 23 | 35 | |

The Chi square test shows statistically significant differences between the two groups of women, with and without osteoporosis, in terms of the distribution of the cases of GR (p=0.003) (table I, figure 1).

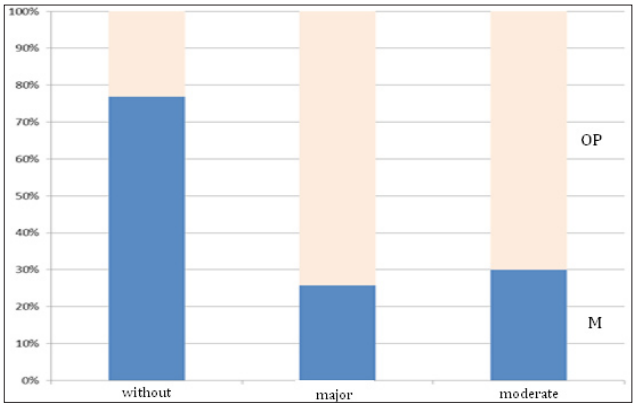


**Figure 1.** Distribution of cases without or with gingival recession (moderate, major) in postmenopausal women with osteoporosis (OP) and without osteoporosis (M).

### Evaluation of the relationship between the mean BMD and gingival recession in postmenopausal women with and without osteoporosis

The test for the variance analysis of the multiple comparisons of ANOVA mean values revealed that the only parameter, for which there was a statistical significance of the differences between the three categories of GR (without, moderate, major), was p=0.034 for the femoral neck BMD (tables II, III and figure 2).

**Table II.** Analysis of the ANOVA variance for multiple comparisons of mean BMD values at different levels depending on the GR (without, major, moderate) in postmenopausal women.

| Recessions | | BMD Mandible | L1-L4 BMD | Femoral Neck BMD | Hip BMD Total |
|---|---|---|---|---|---|
| absent | moderate | 1.30 | 0.96 | 0.89 | 0.91 |
| | N | 8 | 13 | 13 | 13 |
| | Std Dev. | 0.32 | 0.14 | 0.12 | 0.16 |
| major | Mean | 1.23 | 0.87 | 0.79 | 0.85 |
| | N | 15 | 31 | 30 | 30 |
| | Std Dev. | 0.22 | 0.10 | 0.09 | 0.09 |
| moderate | Mean | 1.22 | 0.87 | 0.82 | 0.87 |
| | N | 30 | 50 | 48 | 48 |
| | Std. Dev. | 0.23 | 0.15 | 0.11 | 0.12 |
| Total | Mean | 1.23 | 0.88 | 0.82 | 0.87 |
| | N | 53 | 94 | 91 | 91 |
| | Std. Dev. | 0.24 | 0.14 | 0.11 | 0.12 |

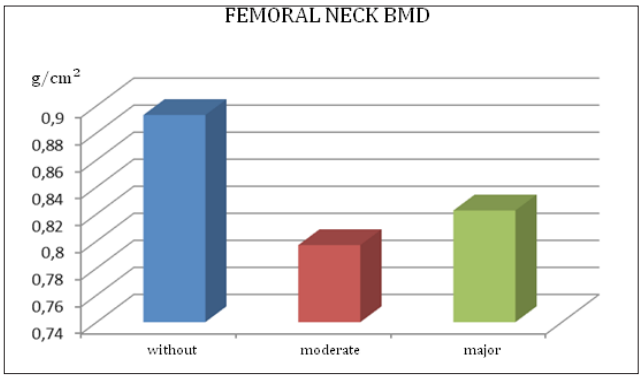


**Figure 2.** Correlation of the femoral neck BMD with the three types of GR in postmenopausal women.

Consequently, in order to highlight the relationship between BMD values and the GR more precisely, the recession variable was recoded as a yes/no variable to allow analysis with the Student test for independent samples (tables IV, V).

**Table III.** ANOVA Test.

| | | Sum of squares | df | Square mean | F | p |
|---|---|---|---|---|---|---|
| Mandible* BMD recessions | Between groups (Combined) | 0.046 | 2 | 0.023 | 0.387 | 0.681 |
| | In the groups | 2.993 | 50 | 0.060 | | |
| | Total | 3.039 | 52 | | | |
| L1-L4 * BMD recessions | Between groups (Combined) | 0.093 | 2 | 0.047 | 2.417 | 0.095 |
| | In the groups | 1.752 | 91 | 0.019 | | |
| | Total | 1.845 | 93 | | | |
| BMD Col Femural * recessions | Between groups (Combined) | 0.084 | 2 | .042 | 3.500 | 0.034 |
| | In the groups | 1.057 | 88 | .012 | | |
| | Total | 1.141 | 90 | | | |
| Hip BMD Total * recessions | Between groups (Combined) | .040 | 2 | .020 | 1.312 | 0.275 |
| | In the groups | 1.352 | 88 | .015 | | |
| | Total | 1.393 | 90 | | | |

**Table IV.** Student t test analysis to compare mean BMD values at different levels, according to the gingival recession in postmenopausal women.

| | Recession (yes/no) | N | Mean value | Std. Dev. | Std. Error of the mean value |
|---|---|---|---|---|---|
| Mandible BMD | Yes | 45 | 1.22 | .22 | .03 |
| | No | 8 | 1.30 | .32 | .11 |
| L1-L4 BMD | Yes | 81 | .87 | .13 | .01 |
| | No | 13 | .96 | .14 | .03 |
| Femoral Neck BMD | Yes | 78 | .81 | .10 | .01 |
| | No | 13 | .89 | .12 | .03 |
| Hip BMD Total | Yes | 78 | .86 | .11 | .01 |
| | No | 13 | .91 | .16 | .04 |

Since the Levene test for equality of variances showed (p=0.898) that in the two groups there were no statistically significant differences of variances, the Student t test was used for equal variances. Its probability p=0.030 showed that there were significant differences between the mean values of L1-L4 BMD according to the presence or absence of GR (figure 3).

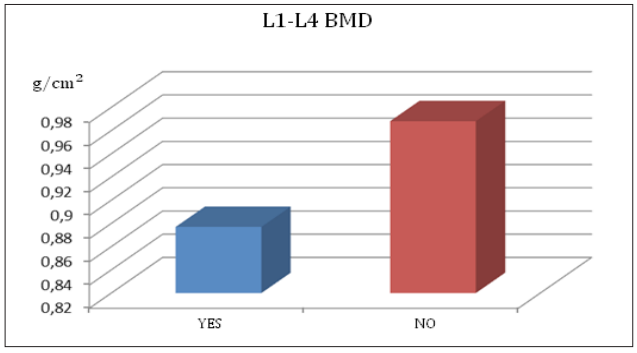


**Figure 3.** The mean L1-L4 BMD values according to the presence or absence of GR in postmenopausal women.

Since the Levene test for equality of variances showed (p=0.545) that in the two groups there were no statistically significant differences of variances, the Student t test was used for equal variances. Its probability p=0.016 showed that there were significant differences between the mean femoral neck BMD values according to the presence or absence of the GR (figure 4).

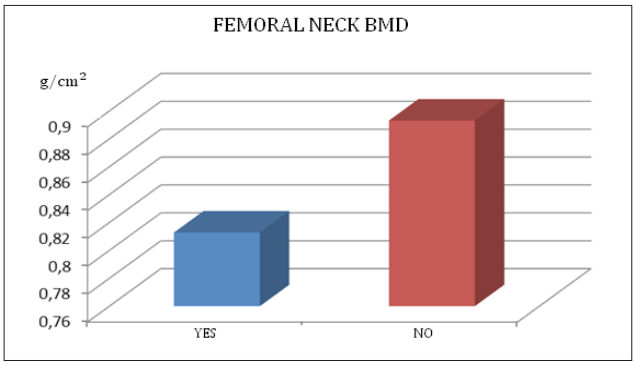


**Figure 4.** Mean femoral neck BMD values according to the presence or absence of GR in postmenopausal women.

## DISCUSSION

The periodontal disease is evaluated by means of clinical parameters such as the gingival index, periodontal index, gingival recession, the degree of tooth mobility.

The retraction of the free gingival margin may have several causes and can take on various clinical manifestations, including combinations of forms.

Pure gingival recession occurs in the absence of inflammation and, according to some authors, represents 5-10% of all epithelial insertion losses [1]. This type of recession often occurs in the dystrophic forms of the periodontal disease [1,5].

The inflammatory gingival recession of chronic marginal periodontitis usually progresses slowly (sometimes during several years) and involves both the gingival margin and the interdental papillae. Most of the times, in these situations, the GR occurs by being pushed apically because of the sub- and supra- gingival calculus. The major GR in the various forms of the periodontal disease can lead to exposure of the root furcation in the pluriradicular tooth region [6].

The findings of the present study show that there were statistically significant differences between the two groups of postmenopausal women, namely: with and without osteoporosis, in terms of the distribution of cases of gingival recession. The group with osteoporosis presented a statistically significant larger number of cases

**Table V.** Student test for independent samples.

| | | Levene test for equality of variances | | Student test for equality of mean values | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Signifi-cance | Mean difference | Std error of difference | Confidence interval difference Inf | Sup |
| Mandible BMD | Equal variances | 1.45 | .233 | -.864 | 51 | .392 | -.08 | .092 | -.2670 | .10635 |
| | Unequal variances | | | -.676 | 8.28 | .517 | -.08 | .11 | -.3526 | .19199 |
| L1-L4 BMD | Equal variances | .01 | .898 | -2.208 | 92 | .030 | -.09 | .04 | -.1729 | -.00916 |
| | Unequal variances | | | -2.162 | 15.85 | .046 | -.09 | .04 | -.1804 | -.00170 |
| Femoral Neck BMD | Equal variancea | .36 | .545 | -2.446 | 89 | .016 | -.08 | .03 | -.1455 | -.01508 |
| | Unequal variances | | | -2.193 | 15.09 | .044 | -.08 | .03 | -.1583 | -.00229 |
| Hip BMD Total | Equal variances | 2.84 | .095 | -1.246 | 89 | .216 | -.04 | .03 | -.1201 | .02752 |
| | Unequal variances | | | -.994 | 14.19 | .337 | -.04 | .04 | -.1460 | .05348 |

with recession (moderate - 57% and major - 37%) than the control group (45% moderate and major 24%).

In assessing the relationship between BMD and the mean GR, the test for analysis of variances for multiple comparisons of the ANOVA mean values revealed that the only parameter for which there was a statistical significance of the differences between the three categories of GR (absent, moderate, major) was the femoral neck BMD.

Consequently, in order to outline the relationship between the BMD values and the recession more precisely, the recession variable was recoded into a yes/no variable, to allow the analysis with Student test for independent samples. The student t test showed significant differences between the L1-L4 BMD mean values and the femoral neck BMD mean values, according to the presence or absence of the GR. The lower the BMD values were, the more gingival recession signs could be noticed. This was due to the estrogen deficiency which altered the metabolism of the gingival junction tissue, resulting in periodontitis. The loss of estrogen led to increased levels of IL-6 in the bone marrow, serum and gum. The reduction of estrogen may be an etiologic factor for atrophic gingival manifestations. There are few studies in international literature about the relationship between osteoporosis and gingival recession, while in the national literature no such studies were conducted.

As in our research, Von Wowern et al. found a greater loss of gingival attachment in women suffering from osteoporosis than in women without osteoporosis [7]. Also Mohammad et al. analyzed the relationship between the clinical periodontal condition and the BMD in the vertebral column. The GR was more common in the group with low mineral density compared to the group with increased bone density. The findings of this study show that osteoporosis is associated with periodontal attachment loss and GR [8]. Further recent research studies, such as LaMonte et al. [9], Brennan et al. [10], Pepelassi et al. [11] have demonstrated the existence of a connection between the presence of osteoporosis and gingival recession.

## Conclusions

1. The prevalence of moderate and major gingival recession was statistically significantly higher in the group of postmenopausal women with osteoporosis (moderate - 57%, major - 37%) than in the group without osteoporosis (moderate - 45%, major - 24%).

2. In postmenopausal women, statistically significant differences were found between the femoral neck BMD values according to the three types of gingival recession (absent, moderate and major).

3. The mean L1-L4 BMD values and the femoral neck BMD were significantly lower in the women with gingival recession compared to those without gingival recession.

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