

## Bone levels in patients with osteoporosis and periodontal disease

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The constantly present dilemmas concerning the existence /non-existence of a relationship between bone density and periodontal disease gave us the idea to do this research. Our study covered 128 female patients in post menopause who were, on the basis of their densitometry findings, divided into three groups (healthy, with osteopenia, with osteoporosis). All the patients under research were clinically examined and dental X-rayed (orthopantomogram). Results were processed statistically and compared to the relevant reference data. On the basis of the obtained results we came to the conclusion that there is a relationship between periodontal disease and systemic osteoporosis.

**Key words:** Osteoporosis, Osteopenia, Periodontal disease.

### Introduction

Periodontal disease belongs to the group of diseases with more than one cause, as a disease of multifactorial etiology. The disease is caused by local etiological factors, causing immunological reaction and interaction with both systemic and genetic components in the organism. Although bacteria are the major cause of the disease, the immunoinflammatory reaction of the host is responsible for the majority of destructive changes

of periodontal tissue. Loss of alveolar bone is the most critical factor in the pathogenesis of periodontal disease. The loss of the bone in fact marks the irreversibility of the pathological process (1). Resorption of the alveolar bone is explained by various mechanisms. Their common denominator is the activation of osteoclasts demineralising the bone and degrading non collagenous matrix (2).

Osteoporosis is a metabolic bone disease with typical reduction of bone tissue quantity per volume unit of anatomic bone, these

bones are mechanically less valuable and the possibility of fracture with insignificant trauma is increased (3, 4). Loss of bone mass in osteoporosis occurs because the activity of osteoclasts is either increased or extended so that resorption is large. It is also possible that it appears because of the weaker or shorter activity of osteoclasts which results in insufficient filling of resorbed surfaces. Recent research shows that both processes take place at the same time. It is nowadays considered that osteoporosis is not just one disease, but a heterogeneous disorder with a number of causes (5). The disease is primarily developed in women and is especially observable in post menopause.

In last ten years a large amount of research was done on the influence of systemic bone mass loss in osteoporosis on the periodontal disease appearance. Krall thinks that alveolar bone loss in patients with lower bone mineral density can be faster and less resistant to therapy than in patients with normal bone density (6). Jeffcoat came to the conclusion that a quarter of postmenopausal women has faster bone mass loss (5-8% a year) and is at higher risk of mass and alveolar bone loss and periodontal disease (7).

The goal of the research was to study the connection between systemic bone mass loss and periodontal disease in postmenopausal women.

## Material and methods

Our study comprised 128 female patients (age 50-60 years) who were in natural post menopause. On the basis of densitometry results obtained by means of bone mass measurement using dual energy x-ray absorptiometry (DXA) from two points on the skeleton - between the first and fourth lumbar vertebra and part of the femur neck which

shows the total spinal mineral content, including data on both trabecular and compact bone, as well as bone mass in the area of the hip bones, and fracture risk assessment (8). The patients were divided into three groups (healthy, with osteopenia, with osteoporosis) where the examined group included patients with osteopenia and osteoporosis and the control group included healthy patients. All the patients under research went through a clinical evaluation (measurement of periodontal pocket depth for each tooth from two sides – medial and distal). They were dental x rayed (orthopantomogram). On the basis of the orthopantomogram analysis the mandible bones resorption type was determined (9). The horizontal type of alveolar bone resorption is the line on the resorptive bone surface, which together with the vertical tooth axis, forms the right angle - suprabony pocket. The vertical type of the alveolar bone resorption is the line on the resorptive bone surface, which together with the vertical tooth axis, forms the acute angle - infrabony pocket. The combined type of the alveolar bone resorption can be seen on the orthopantomogram as a combination of the horizontal and vertical resorption type (suprabony and infrabony pockets).

Statistical analysis comprised basic statistical data: arithmetical means, standard arithmetical mean error and standard deviations, as well as the following statistical analysis tests: Post-hoc analysis (Bonferroni test), Hi-test quadrangle and T-tests for independent samples.

## Results

It is evident that 69 patients (90.8%) have periodontal bone resorption and only 7 patients (9.2%) do not have periodontal bone resorption (Figure 1).

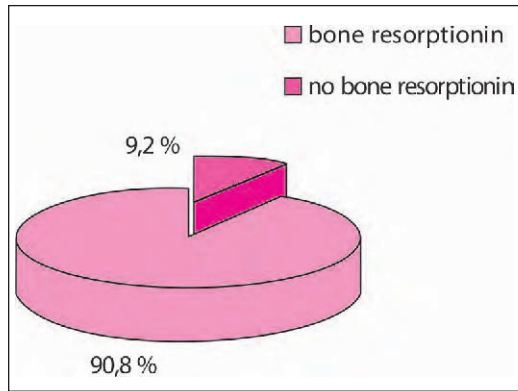


Figure 1 Percentual presentation of mandible bone periodontal resorption for the whole sample

Table 1 Interrelation of periodontal pocket depth with groups of patients

Groups	M	SD	N
Healthy Patients	3.51	0.68	24
Patients with osteopenia	3.46	0.77	26
Patients with osteoporosis	4.14	0.83	26
Total	3.71	0.82	76

M - Arithmetical mean, SD - Standard deviation  
The Levens test of variance equality:  $F(2.74) = 0.10, p = 0.90$

Table 2 Group comparison using Bonferroni test

Groups	$M_{diff}$	$S_e$	Sig.	95% Confidentiality Interval	
				Lower	Upper
Healthy Patients	0.04	0.22	1.000	-0.49	0.58
Patients with osteopenia	-0.64	0.22	0.014	-1.17	-0.10
Patients with osteoporosis	-0.68	0.23	0.006	-1.20	-0.16

Table 3 Relationship between presence of combined type of periodontal alveolar bone resorption and groups

		Groups			Total	
		Healthy Patients	Patients with osteopenia	Patients with osteoporosis		
Presence of Combined Type of Bone Resorption	Yes	Frequency	0	1	5	6
		% between groups	0.0%	16.7%	83.3%	100.0%
	No	Frequency	24	25	21	70
		% between groups	34.3%	35.7%	30.0%	100.0%
Total	Frequency	24	26	26	76	
	% between groups	31.6%	34.2%	34.2%	100.0%	

Post-hoc analysis (Bonferroni test) showed that the average values of pocket depth in healthy patients ( $M = 3.51$ ) are statistically significantly lower (at 98% significance level) than the average values of pocket depth in patients with osteoporosis ( $M = 4.14$ ). We determined, by the same analysis, that the average values of pocket depth in patients with osteopenia ( $M = 3.46$ ) are statistically significantly lower (at 98% significance level) than the average values of pocket depth in patients with osteoporosis ( $M = 4.14$ ). The average values of periodontal pocket depth in healthy patients and patients with osteopenia are not statistically significantly different. ( $p = 1.00$ ).

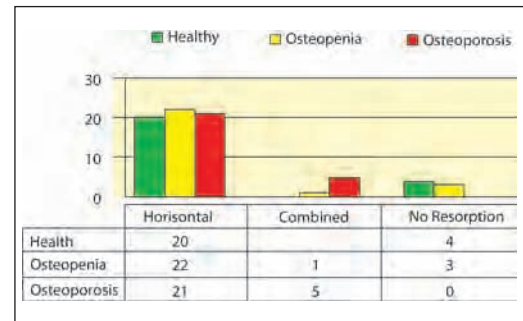


Figure 2 Frequency of various types of periodontal resorption according to groups of patients based on orthopantomogram

In all three groups of patients horizontal alveolar bone resorption is obvious.

The combined type of resorption is detected in 5 patients with osteoporosis, in only 1 patient with osteopenia and it is not detected in healthy patients.

The Hi-test quadrangle indicates the relationship between the combined type of bone resorption and osteoporosis (i.e. groups). The presence of the combined type of bone resorption is more frequent (at 97% significance level) in patients with osteoporosis ( $f = 5$ ) in comparison to healthy ones ( $f = 0$ ) and to the patients with osteopenia ( $f = 1$ ).

Table 4 Interrelation of the depth of periodontal pocket (measured clinically and via X rays) in relation to the presence of bone resorption

	Presence of Alveolar Bone Resorption	N	M	SD	$S_e$
Depth of Pocket Measured Clinically	Yes	69	3.05	0.66	0.08
	No	7	2.14	0.13	0.05
Depth of Pocket Measured via X rays	Yes	69	3.85	0.72	0.09
	No	7	2.32	0.15	0.06

M - Arithmetical mean, SD - Standard deviation,  $S_e$  - Standard arithmetical mean error

The Levens test of variance equality proved to be statistically significant in both cases of pocket depth measurement, indicating that variances of average pocket depth values are statistically significantly different in relation to the presence of bone resorption.

Table 5 Interrelation of periodontal pocket depth with combined type of alveolar bone resorption

	Combined type of alveolar bone resorption	N	M	SD	$S_e$
A. Depth of Pocket Measured Clinically	Yes	6	4.22	0.73	0.29
	No	70	2.86	0.56	0.07
B. Depth of Pocket Measured via X rays	Yes	6	5.32	0.83	0.34
	No	70	3.57	0.66	0.08

M - Arithmetical mean, SD - Standard deviation,  $S_e$  - Standard arithmetical mean error

A. The Levens test of variance equality:  $F(1.74) = 0.42, p = 0.52$ .

B. The Levens test of variance equality:  $F(1.74) = 0.53, p = 0.47$ .

Levens' test of the variance equality did not prove to be statistically significant in either case of pocket depth measuring, indicating that variances of the average depth pocket values are not statistically significantly different in relation to the presence of combined alveolar bone resorption type.

Table 6 T-tests for independent samples

T	df	Sig.	$M_{diff}$	$S_e$	95% Confidentiality Interval	
					Lower	Upper
					5.542	74
6.120	74	0.000	1.75	0.29	1.18	2.32

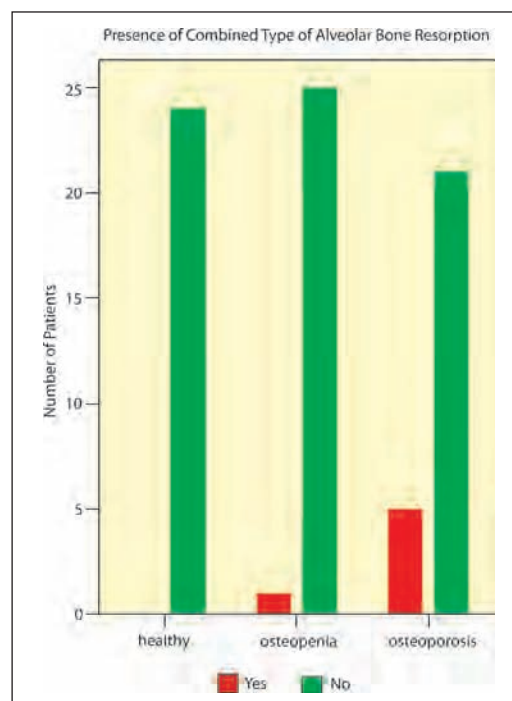


Figure 3 Presence of combined type of alveolar bone periodontal resorption in relation to groups

A. The T-test established that the average value of the pocket depth measured clinically in the case of the presence of combined resorption of the alveolar bone ( $M = 5.32$ ) is statistically considerably higher (at 99% significance level) in

comparison to cases in which the combined type of bone resorption was not recorded. ( $M = 2.86$ ).

B. The T-test established that the average value of the pocket depth measured by X rays in the case of the presence of the combined resorption of alveolar bone ( $M = 4.22$ ) is statistically considerably higher (at 99% significance level) in comparison to the cases in which the combined type of bone resorption was not recorded. ( $M = 3.57$ ).

The combined type of alveolar bone resorption is more frequent in patients with osteoporosis in comparison to both healthy ones and those with osteopenia.

## Discussion

Tezal et al., Pilgrae et al. and Chohayeb connect skeleton bone mass density BMD with alveolar bone loss and also with evident clinical connection loss and they conclude that there is a connection between postmenopausal osteoporosis and periodontal status (10, 11, 12) which is equivalent to our results showing that the average pocket depth value is statistically significantly different in relation to skeleton BMD (Table 1 and 2). We can compare our results (Table 3) with the results arrived at by Hildebolt, Shen et al. and Von Wonen et al. and agree that BMD does change with age and that the change is accompanied by alveolar bone changes. (13, 14, 15). Geurs et al. studied the connection between systemic bone loss (measured by DXA) and periodontal disease (measured by periodontal pocket depth). They concluded that the patients with osteoporosis have greater epithelial connective tissue loss than the patients without osteoporosis, i.e. that the greatest epithelial connective tissue loss is in patients with both periodontal disease and osteoporosis. Our results correspond to the results of Geurs et al. who consider that this indicates that osteoporosis or lower values of skeleton BMD should be consid-

ered as a risk factor for the development of periodontal disease (16). In their study, Wactawski-Wende, discovered a significant connection between periodontal connective tissue loss, as an indicator for periodontitis, and skeleton osteoporosis measured by DXA, especially in postmenopausal women (17). These results correspond to the results of our research (Figure 3) and also with the results of Klemetti et al. (18) who studied the postmenopausal women with significantly deep periodontal pockets and detected greater BMD loss in relation to the patients with shallow periodontal pocket or no periodontal pockets. On the basis of their research they concluded that there is a relation between BMD and periodontal disease.

## Conclusion

Based on the results obtained we can conclude that there is a relation between alveolar bone resorption at postmenopausal women and systemic osteoporosis.

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