The relationship between mineral status of the organism and the number of teeth present and periodontal condition in postmenopausal patients

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Abstract

Purpose: The determination of the relationship between the mineral status of the organism and the number of teeth present and periodontal condition in women after menopause.

Material and methods: The study covered 65 postmenopausal women with partial loss of dentition, mean age was 66.2 years. The group was divided into 3 subgroups: healthy, with osteopenia and with osteoporosis. The division was made on the basis of the results of densitometric analysis (BMD) of femoral neck (F) and the lumbar spine (L2-L4), according to diagnostic criteria concerning the density of bone mass according to WHO. The number of teeth present was taken into consideration in the clinical examination. Periodontal condition was evaluated using CPITN index.

Results: The total number of own teeth strongly negatively correlated with the results of the lumbar spine densitometry. The correlation between mineral density of the lumbar spine and the femoral neck and the number of teeth in the maxilla was also strongly negative. However, the significant relationship between the number of teeth present in the mandible and the mineral density of examined bones was not observed. We did not state the increase in periodontal changes advancement together with the decrease in mineral status in the examined group of women.

Conclusions: There was not any influence observed of the decreased mineral status of the organism on the number of own teeth and the degree of periodontal disease advancement.

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Received 24.02.2006 Accepted 06.03.2006

Key words: mineral status of the organism, teeth, periodontium, menopause.

Introduction

Atrophy of the jaw bones is caused by numerous factors. However, so far the prevalence of either local or general factors in the etiopathogenesis of this process has not been determined. According to many authors, general loss of bone tissue in the course of metabolic bone disorders affects the masticatory organ. It can be reflected by early teeth loss, periodontitis intensification and advanced basal bone atrophy [1-4]. On the other hand, some authors claim that locally acting forces, together with systemic factors, modifying bone tissue resorption, are most vital in the pathogenesis of maxillary and mandibular bone atrophy [5-7]. Still others think that the decrease in mineral status has only indirect effect on bone atrophy, through acceleration of teeth loss and intensified course of periodontitis [8-12].

The aim of the study was the determination of the relationship between the mineral status of the organism and the number of own teeth and periodontal condition in postmenopausal patients.

Material and methods

The study was conducted in the group of 65 postmenopausal women with partial lack of dentition. The mean age of patients was 66.2 years.

The group was divided into 3 subgroups: healthy, osteopenic and osteoporotic. The division was made on the basis of the results of the densitometric examination (BMD) of the femoral neck (F) and the lumbar spine (L2-L4), following the criteria of diagnostic evaluation of bone mass density according to WHO [13].

Densitometric examination was performed using the method of Dual Energy X-ray Absorptiometry (DEXA) with

Table 1. **Mean number of teeth present in particular subgroups**

Subgroup	Number of teeth in maxilla	Number of teeth in mandible	Total number of teeth
Osteoporosis n=25	7.7±0.8	8.8±0.5	16.5±1.2
Osteopenia n=26	6.6±0.6	7.1±0.6	13.7±1
Healthy n=14	5.4±1.2	7.6±1	13±1.9

Table 2. **Correlation between bone mineral density of the lumbar spine (BMD L) and the femoral neck (BMD F) and the number of teeth in group with partial dentition**

Number of teeth	BMD L		BMD F	
	r	p	r	p
Total	-0.2537*	0.043*	-0.1931	0.126 n.s.
Maxilla	-0.2707*	0.031*	-0.2505*	0.046*
Mandible	-0.1697	0.18 n.s.	-0.0742	0.56 n.s.

r – correlation coefficient; * – statistically significant; n.s. – statistically insignificant

Table 3. **Periodontal condition in particular subgroups expressed in number (n), percentage (%), and the mean of sextants per person (m) according to CPITN index**

Group	Number of subjects	Number of sextants		Sextant excluded	Healthy periodontium	Gingival bleeding	Dental calculus	Pockets 3-5 mm	Pockets above 6 mm
				X	0	1	2	3	4
Healthy	14	84	n	37	7	12	20	8	-
			%	44	8.3	14.3	23.8	9.5	-
			m	2.6	0.5	0.9	1.4	0.6	-
Osteopenia	26	156	n	58	6	44	44	3	1
			%	37.1	3.8	28.2	28.2	1.9	0.6
			m	2.2	0.2	1.7	1.7	0.1	0.03
Osteoporosis	25	150	n	46	16	38	38	10	2
			%	30.6	10.7	25.3	25.3	6.7	1.3
			m	1.8	0.6	1.5	1.5	0.4	0.08
Total	65	390	n	141	29	94	102	21	3
			%	36.6	7.4	24.1	26.2	5.4	0.8

a bone densitometer Lunar DPX-L (USA). The results were expressed in g/cm^2.

The history data included the age, duration of menopause, lifestyle, nutritional habits. Patients with low body mass, secondary osteoporosis and other metabolic disorders as well as those treated with the hormonal replacement therapy were excluded from the study. The number of teeth present in the maxilla and in the mandible was taken into consideration during the clinical examination. Periodontal condition was assessed using Community Periodontological Index of Treatment Needs (CPITN).

The results were expressed as arithmetic means considering the standard deviation (SD). Pearson linear correlation coefficient was used to evaluate the interdependence between examined parameters. Correlation was considered to be significant at the values of $p<0.05$. The calculations were performed using Statistica 6 IBM.

Results

Tab. 1 presents the number of teeth present in patients in particular subgroups.

The highest number of teeth was noticed in patients with osteoporosis – 16.5±1.2 while the lowest – in the subgroup of healthy women – 13±1.9. The patients with osteopenia revealed the lowest number of teeth in the mandible – 7.1±0.6 whereas the healthy subgroup – 5.4±1.2 in the maxilla. The patients with osteoporosis had the highest number of teeth in the mandible and in the maxilla (8.8±0.5 and 7.7±0.8, respectively).

Tab. 2 shows the analysis of the relationship between the mineral condition, determined on the basis of mineral density examination of the femoral neck and the lumbar spine, and the number of teeth. The overall number of own teeth and the results of the densitometric examination of the lumbar spine were in the strong negative correlation. The strong negative correlation was also observed between the mineral density of the lumbar spine and the femoral neck and the number of teeth in the upper jaw. However, we did not find any significant relationship between the number of teeth present in the mandible and the mineral density of the examined bones.

Periodontal condition of examined subjects is presented in *Tab. 3*.

The condition of 390 sextants in general and in particular subgroups was assessed, out of which 141 sextants (36.6%) were excluded from the study. The mean number of excluded sextants was the highest in the subgroup of healthy women (2.6) while it was the lowest in the subgroup with osteoporosis (1.8). The subgroup with osteopenia revealed the lowest number of

sextants with healthy periodontium (CPI=0) (3.8%) while in the subgroup with osteoporosis it was the highest (10.7%) and in healthy comprised 8.3%. Gingival bleeding (CPI=1) and dental calculus (CPI=2) occurred least frequently in the subgroup of healthy persons (14.3% and 23.8%, respectively), the distribution was identical in the subgroup with osteopenia (CPI=1 – 28.2% and CPI=2 – 28.2%) and with osteoporosis (each CPI – 25.3%). The pockets of 3-5 mm (CPI=3) were present in 9.5% of healthy individuals, in 1.9% of patients with osteopenia and 6.7% of osteoporosis patients. The values were expressed per person as 0.6, 0.1, and 0,4 respectively. Advanced lesions in periodontium (CPI=4) did not occur in healthy controls, however in the subgroups with osteopenia and osteoporosis constituted 0.6% and 1.3%, respectively.

Discussion

The analysis of the relationship between the results of densitometric examinations and the number of teeth present showed strongly negative correlation between the results of the femoral neck and the lumbar spine density measurements and the number of teeth in the maxilla as well as between the result of the lumbar spine BMD and the total number of own teeth. We did not observe any statistically significant interdependence between the number of teeth in the mandible and the mineral density of the examined bones. Thus, it can be concluded that osteoporosis did not cause any accelerated loss of teeth. Moreover, the patients with lower BMD showed higher predisposition to keep the natural dentition, specifically in the mandible. It can be connected with more care of the oral health state. Klemetti et al. [6] did not connect the lowered mineral status with earlier or more intense loss of teeth. Mohammad et al. [14] did not present any correlation between spinal mineral density and the number of teeth although the indices concerning the intensity of periodontal disease were significantly higher in the group with low values of densitometric examination.

Rowe [15] analyzed the factors leading to the resorption of jaw bones, including all general factors affecting the decrease in bone mass and observed that tooth loss was the effect and not the cause of osteoporosis-derived resorption. The author claimed that the pattern of resorption was, among others, the result of innate predisposition to resorption at specific sites along the alveolar crest, which develops as the organism grows and later can favor teeth loss. Mattson et al. [16] stated that it was difficult to establish the direct connection between increased loss of teeth, bone atrophy or periodontal disease and osteoporosis as local symptoms pointed above occurred in some patients while others did not manifest any of them. Bando et al. [17] suggested that the satisfactory efficiency of mastication in patients with natural dentition and healthy periodontium might be a jaw bone protective factor against osteoporosis.

The relationship between the degree of periodontopathy intensity and osteoporosis has not been explicitly determined. Inagaki et al. [18] noticed the increase in periodontal disease intensity and advanced tooth loss in women with decreased mineral density of metacarpal bones. Von Wowern et al. [19] stated that advanced osteoporosis, which reduces to a great extent, the mineral content of the jaw bones, could be connected with lack of epithelial attachment of the gingiva. On the other hand, Wactawski-Wende [20,21] connected the decrease in mineral status only with chronic periodontal diseases. The author claimed that osteopenia could play a role in the pathogenesis of periodontopathy though the bacterial etiology of the disease had already been established. According to him, the same factors causing or modifying the course of both diseases (cigarette smoking, hyponutrition, age, corticosteroids applied or the immune system dysfunctions) constitute an important argument which confirmes the thesis. Baker [22] stressed that osteoporosis, like periodontal disorders, was connected with bone metabolism disturbances. A significant factor, that connects both ailments, is interleukin 6. Its level is increased as estrogen concentration decreases and in the course of periodontitis. If the diseases coexist, the increase in IL-6 level, connected with each of them, can enlarge the atrophy of the alveolar process. Periodontopathies are also intensified with age and generalized decrease in bone density can contribute to predisposition to the atrophy of the alveolar bone. Philstrom [23] claimed that osteoporosis is only a risk factor of periodontopathy occurrence in patients with poor oral hygiene and large amount of dental calculus.

Our results, based on CPITN, did not confirm the increase in periodontal disease advancement in people with lowered mineral status. The highest number of healthy sextants was stated in the subgroup with osteoporosis while the pockets of 3-5 mm in depth occurred more often in the healthy group. As far as most advanced changes in periodontium are concerned, they were not observed in healthy subjects and in the subgroups with osteopenia and osteoporosis, the percentage of sextants with the highest code was only 0.6% and 1.3%, respectively. The results were in accordance with other authors' reports. Klemetti et al. [48] also used CPITN index and stated its higher values (more advanced disease) in patients with better mineral status of the organism. However, the authors claimed that healthy individuals with deep periodontal pockets had less problems with maintaining their own dentition than patients with osteoporosis. Others did not find any direct relationship between the degree of periodontopathy intensity and osteoporosis advancement [24-26]. Norderyd et al. [27] observed the decrease in gingival pocket bleeding index in patients with the hormonal replacement therapy. However, neither the loss of the epithelial attachment of the gingiva nor bone resorption was lower in this group as compared to the patients without the hormonal replacement therapy. According to the authors, estrogen supplementation only enables the treatment of gingivae. Numerous differences of examination methods, both of mineral status and periodontal assessment, make it difficult to compare our results with that described in the literature.

Conclusions

The influence of decreased mineral status of the organism on the number of teeth present and on the degree of periodontal disease advancement was not observed in the examined group of women.

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