



Tooth loss and bone mineral density among postmenopausal women

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ABSTRACT

Loss of teeth by patients has been currently a big problem, not only aesthetic one but also health-related. There are many reports describing the relationship of periodontal disease, alveolar bone resorption and loss of teeth with reduced bone mineral density. The aim of this study was to examine the relationship between the loss of bone mineral density of the spine and the number of teeth present in the oral cavity of patients during the study. Our results are confirmed by world literature reports, that the number of teeth present in the oral cavity in postmenopausal women correlates with bone densitometry measurements.

Keywords: tooth loss, osteoporosis, bone mineral density, women

INTRODUCTION

Loss of teeth by patients has been currently not only a big aesthetic problem, but also health-related one. Loss of chewing surface has a negative impact on the ability of food grinding, and thus may have implications in the dysfunction of the digestive system and the ability to digest and absorb food intake. The loss of teeth is related to an increased risk of chronic inflammation of stomach and duodenum, an increased risk of insulin-dependent diabetes, increased risk of cardiovascular and chronic kidney diseases [6].

Loss of teeth may result from local and general factors. The local factors include caries disease, periodontal disease, dental and periodontal injuries, decreased saliva production [4]. The general factors include diet, hygiene habits, addictions, systemic diseases affecting the status of the hard tissues of the teeth and periodontium. Loss of teeth can be not only a consequence of the ongoing disease process, but also a predictor of disease states helping in their diagnosis or prognosis of development. Among numerous factors associated with tooth loss there are also relationships between osteoporosis and tooth loss.

Osteoporosis is a disease that involves quantitative and qualitative changes in the bones leading to fractures

[7,12]. It is considered to be one of civilization diseases including growing number of people over 65 years of age due to progressing aging population in different countries. In practice, postmenopausal women are most at risk of developing osteoporosis due to the expiration of protecting estrogen activity in relation to the bone tissue [10]. Risk factors for osteoporosis include age, time elapsed since menopause, low body mass index, smoking, low calcium intake in the diet [7].

There are many reports describing the relationship of periodontal disease, alveolar bone resorption and loss of teeth with reduced bone mineral density [1,3,8].

AIM

The aim of this study was to examine the relationship between the loss of bone mineral density of the spine and the number of teeth present in the oral cavity of female patients during the study.

MATERIAL AND METHODS

The study included 112 women aged 45 to 74 years of age, in whom menstruation had been stopped for at least 12 months. In the population of studied women, bone mineral density was assessed by DEXA method in the L2-L4 spine with a densitometer Lunar Prodigy GE Healthcare. Dental examination was carried out using dental probe, mirror and WHO 621 probe in artificial light. This study assessed the condition of teeth (including

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the presence of teeth with caries, the presence of filled teeth, the presence of teeth to be removed and missing teeth) and marginal periodontium.

From the data gathered there were calculated:

- the DMFT index,
- Community Periodontal Index of Treatment Needs–CPITN.

DMFT index is the sum of the number of teeth with active primary or secondary caries, teeth removed because of dental caries and filled teeth, where D – is a tooth with one or more cavities of primary or secondary caries, M – means removed tooth because of caries, and F – tooth with one or more fillings, but with no secondary caries.

CPITN index is based on the core symptoms of periodontal disease. It specifies both the prophylactic and therapeutic needs. The study was conducted using a graduated by 2 mm periodontal probe, which ended with a ball of 0.5 mm in diameter. The probe was introduced into the gingival sulcus: centrally, mesially and distally; and lingually. A test of periodontium was made in the six of the following sections: 17-14, 13-23, 24-27, 47-44, 43-33, 34-37. Each of the following sections, in which there are at least two teeth was treated separately. If one tooth was only found, then the value confirmed for this tooth was attached to the adjacent sextant. For each of the six sections of only the diagnosed uppermost value was inscribed. Clinical evaluation was carried out based on code of disease symptoms marked as follows:

- 0 – healthy periodontium,
- 1 – bleeding on probing sulcus, no pathological pockets, tartar and protruding fillings,
- 2 – pockets depth to 3 mm, the presence of tartar or dental plaque, protruding fillings,
- 3 – pockets depth of 4-5mm, bleeding on probing,
- 4 – pockets depth of 6mm and more.

The patients were divided according to the WHO criteria into three groups according to bone mineral density assessed by DEXA method with densitometer Lunar Prodygy. Groups were designated: GRKN – control group, GRBD I – a group of people with osteopenia, GRBD II – a group of people with osteoporosis.

RESULTS

In the study population, the mean age was 58.25 years (57.07 years in the control group – GRKN, 57.32 years in the group with osteopenia – GRBD I, 59.47 years in patients with osteoporosis – GRBD II). The surveyed women ranged in age from 45.1 to 74.2 years. Differences in age were not statistically significant (Table 1).

The highest average DMFT index was found in women with osteoporosis GRBD II – 26 (the range was 12-32), and the lowest value was observed in the control group – 19 (range 15-32). In GRBD I, the average value of the

DMFT index was 25 (range 14-32). This difference was statistically significant.

Table 1. The structure of the study group I and II and the control group, taking into account characteristic parameters of the respondents

Tested parameter	Study group			Statistical analysis
	GRKN	GRBD I	GRBD II	
Age in years	57.07	57.32	59.47	P=0.13
DMFT number	22.52	25.37	25.39	P=0.03
Component D of DMFT number	1.61	2.29	1.61	P=0.26
Component M of DMFT number	11.35	14.21	16.67	P=0.03
Component F of DMFT number	9.56	8.87	7.10	P=0.16
Number of teeth present in oral cavity	19.35	17.74	14.43	P=0.02
CPITN	1.73	1.97	2.09	P=0.32

GRKN – control group; p – statistical significance; GRBD I – subjects with osteopenia; GRBD II – subjects with osteoporosis

Analysis of the individual components of the DMFT index found that in all groups surveyed, the highest average values related to component M. The lowest average values of the individual components of the DMFT index were showed by the D number.

The average number M was 11.35 in the control group, 14.21 in the group with osteopenia and 16.67 in the group with osteoporosis, and the number D in GRKN – 1.61, GRBD I – 2.29 and GRBD II – 1.61, respectively. The range of M number was 1-31, and the range of number D was 1-14 in the overall population. The relationship between the treatment groups in the number M were statistically significant (Table 1).

Number of teeth present in the mouth during the study ranged from 1 to 29. The highest average number of teeth in the mouth was found in the control group (GRKN) – 19.35. Group of patients with osteopenia had an average number of teeth amounting 17.74. Group of patients with osteoporosis had an average of 14.43 teeth. These differences were statistically significant (Table 1).

The lowest percentage of women with more than 20 teeth in the oral cavity was observed in the group of women with osteoporosis GRBD II, the highest – in the control group GRKN. This relationship was statistically significant (Table 2). In addition, the correlation between the number of teeth present in the mouth during the study and the age of patients were investigated. There was no statistically significant correlation between the measured parameters.

Table 2. Analysis of study groups according to the number teeth present in the mouth

Number of teeth in oral cavity	Study groups						Statistical analysis
	GRKN		GRBD I		GRBD II		
	n	%	n	%	n	%	
20	9	39.13	23	60.53	36	70.59	$\chi^2=6.78$ p=0.04
≥ 20	14	60.87	15	39.47	15	29.41	
Total	23	100.00	38	100.00	51	100.00	

The analysis of the CPITN index showed that the highest mean value was found in the group with osteoporosis GRBD II, whereas the lowest in the control group GRKN. These differences were not statistically significant (Table 3).

Among those subjects in whom determination of CPITN index was possible, an analysis was made with division into a group with codes 0-2 and codes 3-4 indicating the presence of medium-deep and deep periodontal pockets. It was noted that totally indices 3 and 4 were observed in approximately 18% of women of GRKN and more than 34% of both GRBD I and GRBD II. Differences in the studied parameters between the groups were not statistically significant (Table 3).

Table 3. The analysis of examined groups of women including the largest CPITN index code

CPITN index value	Study groups						Statistical analysis
	GRKN		GRBD I		GRBD II		
	n	%	n	%	n	%	
0-2	18	81.82	21	65.63	29	65.91	$\chi^2=2.06$ $p=0.35$
3-4	4	18.18	11	34.38	15	34.09	
Total	22	100.00	32	100.00	44	100.00	

The study groups did not differ significantly in terms of age, size, and CPITN index, D and F components of the DMFT index.

DISCUSSION

Many studies have suggested a possible relationship of periodontal disease and tooth loss with osteoporosis and decreased bone mineral density [8,9,11,13,15]. In our study, a statistically significant difference between the two groups of women in terms of the number of teeth present in the oral cavity in relation to spine BMD has also been established.

In the global and Polish literature there are many articles about undertaking the issue of tooth loss with a decrease in bone mineral density of skeleton and jaw [1,2,3,4,8,11,14,15]. Drozdowska et al. [5] in a survey of 67 postmenopausal women have found a statistically significant relationship between BMD of the proximal femur as measured by DEXA method and the number of teeth present in the oral cavity of patients. The study conducted by Reddy et al. [14] of 45 postmenopausal women showed a statistically significant difference between the group with osteoporosis and osteopenia and the group of control subjects.

A significantly smaller number of teeth in patients with osteoporosis in comparison to a group of persons with normal bone mineral density was also confirmed by Inagaki et al. [8] Iwasaki et al. [9], Nicopoulou-Karayianni et al. [13], and Yoshihara et al. [15]. The thesis which states a smaller number of teeth present in the mouth of people with osteoporosis is confirmed by results of own research (the difference between the two groups was statistically significant, $p < 0.02$). Krall et al. [11] conducted a study

lasting seven years on the rate of bone mass loss and teeth loss among postmenopausal women not taking hormone replacement therapy. The results of these observations have shown that people who over the seven-year period of research lost at least one tooth had also significantly reduced bone mineral density compared to those who did not lose teeth. The opposite opinion is stated by Bałczewska [2] and Bollen et al. [3], who do not see the direct impact of osteoporosis on the number of lost teeth.

Among the modifying factors affecting the number of teeth in the mouth there are those directly contributing to the loss of teeth: periodontal disease and dental caries. In our study, these factors have been taken into account based on the results of calculations CPITN index and the DMFT index.

In our study, there was no significant difference in the state of periodontium evaluated with CPITN index in the three groups. The detailed analysis of the distribution of individual codes of CPITN index showed no statistically significant differences between the groups. At the largest percentage of people in all treatment groups gingival pocket depth of up to 3 mm and the presence of calculus were found (code 2). Additional analysis of the three treatment groups showed no statistically significant difference between the groups of women with osteopenia and osteoporosis (GRBD I and GRBD II) and a group of women with normal bone mineral density (GRKN). Similarly, Bałczewska [1] confirmed the lack of correlation between the parameters defining the periodontal status and the BMD level.

Bałczewska conducted extensive research of periodontium condition of patients with a reduced level of BMD [1]. The study included the determination of CPITN index, the SBI (sulcus bleeding index), the clinical measurement of pockets depth (CDP), the measurement of clinical level of attachment (CLA) and the measurement of gingival recession (GR). The author concluded that both CPITN index, sulcus bleeding index (SBI) and the rate of loosening of teeth (LT) did not differ significantly between groups. Inagaki et al. [8], who studied the relationship between metacarpal BMD and the CPITN among 190 women, reached other conclusions. They noted a tendency to the occurrence of moderate and severe form of periodontal disease, coded 3 and 4, with a decrease in BMD. They did not notice any influence of other factors such as smoking, number of teeth with caries and filled ones. The positive correlation between lower BMD and the periodontal disease related to both premenopausal and postmenopausal groups of women.

So far, few studies aiming at assessment of the impact of reduction in bone mineral density and the factors that cause the condition on the hard tissues of the tooth have been conducted. There are few reports of dental caries in relation to osteoporosis [2,12]. Our results indicate sig-

nificant differences between the study groups in the DMFT index (statistical significance $p = 0.03$). Analysis of the individual components showed that the largest differences between the groups were in the M component and they were statistically significant ($p = 0.03$).

However, the average values of the other components of D and F in all three groups were similar. Kunchur and Goss [12] obtained similar results in the average DMFT index, but not the individual components. Bałczewska [2] did not reveal any significant correlations between the average DMFT index and the reduction in BMD. Our results and analysis of Bałczewska are similar in relation to the average values of component D and the DMFT index, but differ in terms of the component M. It can also involve other division into groups and different numbers within groups examined despite a similar total number of respondents. In case of the research by Kunchur and Goss [12], the differences between the results of their studies and own research may have resulted from a different methodology – in the calculation of DMFT index there were used panoramic X-ray images and not clinical examination of the patients.

SUMMARY AND CONCLUSIONS

Our results are confirmed by world literature reports, that the number of teeth present in the oral cavity in postmenopausal women correlates with bone densitometry measurements. It has been found that the smaller number of teeth present in the oral cavity characterized a group of women with lower bone mineral density BMD measured in the lumbar spine L2-L4.

Number of teeth present in the mouth in postmenopausal women may be a predictor of osteoporosis.

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