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*The loss of alveolar processus, mandible density and bone tissue  
structure in reference to the computerized analysis  
of intraoral radiography*

Evaluation of characteristics and bone tissue structure in stomatological diagnosis has special significance in diagnostics of pathological lesions, in programming of implant treatment, and in planning of operation treatment in case of cranial bone fractures (1). Also detection of osteoporotic deviation may have major influence on the selection of treatment and improvement of its efficiency.

Commonly applied conventional roentgenodiagnostics of the stomatognathic system based on dental panorama or teeth X-ray qualitative assessment and the presence of pathological lesions in radiograms appeared with at least 40% loss of bone weight, and testified to significant progression in destruction changes (5, 13). The increased accuracy is characteristic of radiography methods, enabling digital X-ray records (2). An additional computerised review of radiographs allows relative quantitative evaluation of densitometry index as well as determination of features related to bone tissue structure (16, 17).

Density and bone tissue structure of the mandible and maxillae undoubtedly influence dental status and pathological changes may contribute to the loss of teeth. The objective of the study was to find out the correlation between the level of alveolar processus loss and selected densitometry indices as well as indices of bone structure resulting from radiographs.

#### MATERIAL AND METHODS

The study covered 98 patients with preserved dentition in the area of made radiographs, age ranging between 14-73 years, treated in the Department of Dental and Maxillofacial Surgery and Osteoporosis, Outpatient Clinic Institute of Rural Medicine in

Table 1. Amount of treated according to age and gender

	Age group				All
	I	II	III	IV	
Women	20	13	12	16	61
Men	16	13	6	2	37
Total	26	26	18	18	98

Lublin. Statistical analysis patients were divided into four age-related subgroups: 40 years old, 41–50, 51–60 and over 60 years old. Characteristics of the research groups are showed in Table 1.

For the radiographic researches there was a utilized device made by Trophy Radiology type IRI x 708 equipped with head with 2.5 mm Al filter, the tubus and CCD control panel allowing automatic selection of intensity of radiation and exposure timing. Radiographs registered with CCD sensor cover premolar teeth area on the left side using right angle methods developed by Hielscher (7). Registered digital pictures transferred to the computer were converted to the graphical display and reviewed by Radiograph Workshop (18). The degree of loss of alveolar processus was assessed in reference to the measurement of the distance between the tooth neck and the marginal bone of alveolar processus expressed in mm.

The results of research were developed using statistical program Statistic 5.1. Differences of assessed features were evaluated by test t assuming significant values  $p < 0.05$ , but correlations between the selected indices were analysed by defining linear regression assessed by the Pearson's test.

## RESULTS

Results the densitometry researches and parameters of structure are showed in Table 2. Among the patients with preserved dentition, there were defined discrepancies in densitometry index correlated with the patient's gender. Relative biological mineral contents as well as relative biological mineral density of the mandibular bone was lower in female group than in male group.

In the assessment of the correlation between the degree of loss of alveolar processus and the evaluated parameters, the age of the treated patients had the major influence (Fig. 1). As results from the presented data the distance between the tooth neck and alveolar margin increases and the correlation is statistically by significant ( $p < 0.001$ ). The degree of alveolar processus loss also presents negative correlation with the bone

Table 2. Parameters of density and structure in the group of men and women

Parameters		Group		Difference (p =)
		women	men	
Bone mineral content	BMC	0.534–0.090	0.582–0.096	0.0140
Bone mineral density	BMD g/cm <sup>2</sup>	1.211–0.181	1.386–0.212	0.0001
Bone density	BD g/cm <sup>3</sup>	1.454–0.238	1.553–0.202	0.0381
Trabecular density	STD (%)	41.56–3.48	41.85–4.08	0.7058
Trabecular length	STL (/mm)	1.866–0.311	1.865–0.263	0.9788
Trabecular width	STW (mm)	0.226–0.030	0.230–0.031	0.4480

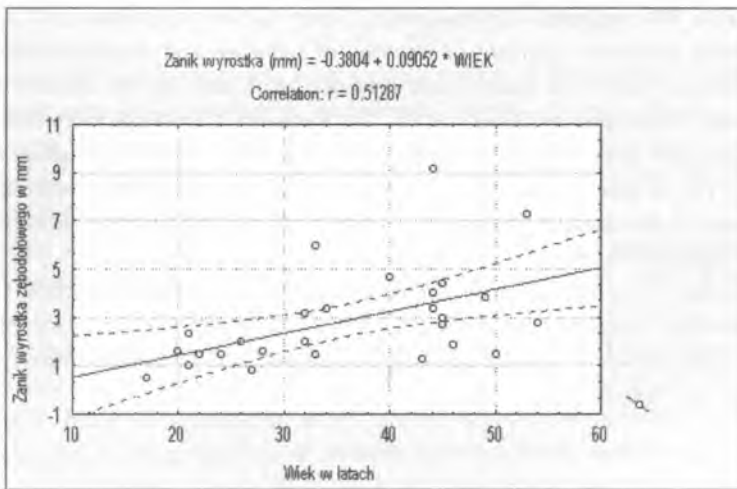


Fig. 1. Correlation between loss of alveolar process and age

mineral density (BMD) and the equivalent of bone mineral contents (BMC) (Figs 2, 3). In both cases the correlation is statistically significant, and the correlation indices are respectively  $-0.2607$  for mineral density and  $-0.2380$  for the equivalent of mineral bone contents. However, no significant correlation between the level of loss of alveolar process and relative bone density (BD) ( $p=0.172$ ), was found. The analysis of dependencies between the level of loss of alveolar process and radiological parameters of the mandibular bone structure shows no correlation with the level of loss of alveolar process and amount of trabecular bones per 1 mm of line (STL) and its width expressed in mm (STW). There was a negative correlation between the density index expressed in % ratio

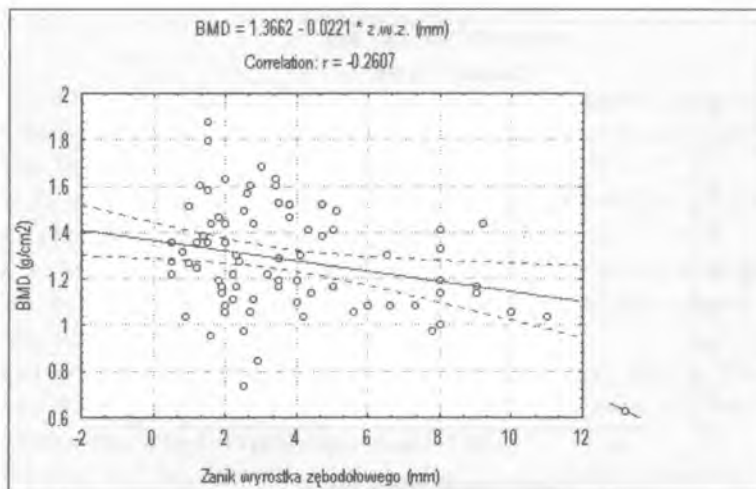


Fig. 2. Correlation between bone mineral density (BMD) and degree of loss of alveolar processus

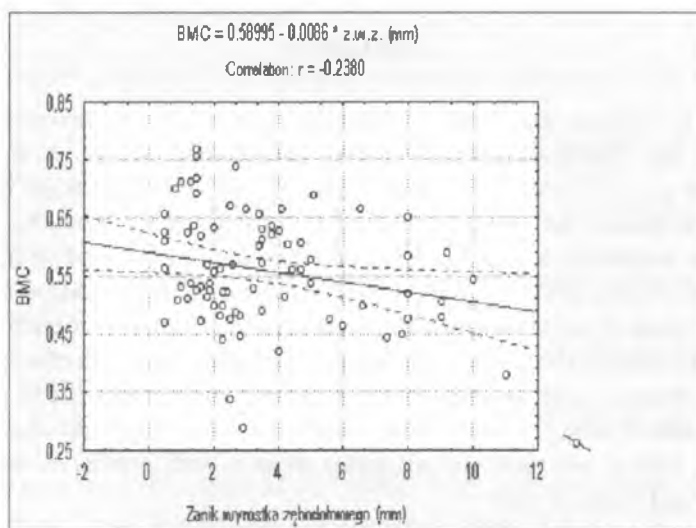


Fig. 3. Correlation between bone mineral contents (BMC) and degree of loss of alveolar processus

of surface trabecular density (STD) – Figure 4. As the chart implies, the decrease in relative trabecular density is accompanied by a significant increase in the level of loss of alveolar processus ( $p < 0.004$ ). A similar dependence was observed in reference to average amount of trabecular bones per 1 mm<sup>2</sup> (STN), structure of trabecular volume (STV) and structure of trabecular height (STH).

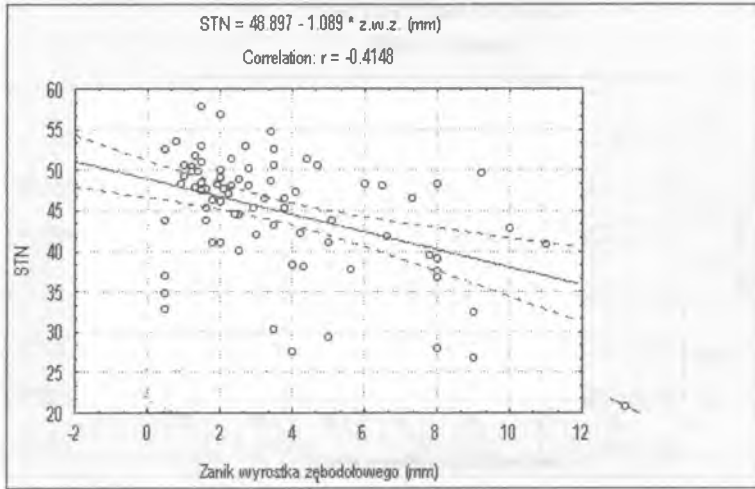


Fig. 4. Correlation between structure trabecular number in 1 mm surface of the bone and loss of alveolar process

## DISCUSSION

Changes in the bone tissue structure, including also craniofacial skeleton are related not only to the physiological ageing process and osteoporosis. As it is defined by Jeffcoat et al. (8, 9) and other authors (3, 4, 6, 7, 14, 19) loss of weight of the bones of the stomatognathic system can be caused by bacterial and inflammable periodontal lesions, some metabolic lesions, hormonal disorders and corticosteroid treatment. Additional factors reducing density as well as maxillary and mandibular structure changes can have a root cause in the stomatognathic system disorders and loss of teeth (12). However, with the current level of science development, finding out, whether reduction in density and changes in the structure of bones of the stomatognathic system are the root cause of changes in teeth, or whether they result from loss of teeth and operation disorders is very difficult, but there are no doubts about a close correlation between bone tissue status and status of teeth.

The above is pointed out by research, which proved the correlation between changes in stomatognathic system bone density and relocation downwards or loss of alveolar process (8, 15, 18). Also proprietary test results proved a variable correlation between the degree of loss of alveolar process, mineral density equivalent, bone mineral density and some other mandible bone mineral structure factors.

The defined correlation allows to assume that demineralisation changes influence loss of teeth. This conclusion is confirmed by earlier research, in which there were defined significantly lower indices of density and mandible bone structure in patients lacking premolar teeth in the location of radiography performing (18).

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2001.10.10

### SUMMARY

98 patients treated in the Department of Dental and Maxillofacial Surgery, Medical University and Institute of Rural Medicine in Lublin had radiovisiographically tested premolar teeth area on the left side. Reviewing radiovisiographical picture, there were defined bone mineral density and mandible bone structure and degree of loss of alveolar processus. It was concluded that the degree of loss of alveolar processus is significantly correlated with the researched patients' age, and is inversely correlated with mineral density and equivalent of mandible bone mineral contents. The achieved results prove that demineralisation changes can significantly influence teeth loss.

Zanik wyrostka zębodołowego oraz gęstość i struktura tkanki kostnej żuchwy  
na podstawie komputerowej analizy obrazu radiowizjograficznego

U 98 pacjentów leczonych w Klinice Chirurgii Stomatologicznej i Szczękowo-Twarzowej AM oraz w Poradni Osteoporozy Instytutu Medycyny Wsi w Lublinie przeprowadzono badania radiowizjograficzne okolicy zębów przedtrzonowych po stronie lewej. Na podstawie analizy obrazu wg określono wybrane wskaźniki gęstości i struktury kości żuchwy oraz stopień zaniku wyrostka zębodołowego. Stwierdzono, iż stopień zaniku wyrostka zębodołowego istotnie koreluje z wiekiem badanych, a także wykazuje ujemną korelację z gęstością mineralną i równoważnikiem zawartości minerałów w kości żuchwy. Uzyskane wyniki wskazują na to, że zmiany demineralizacyjne mogą w znaczący sposób uczestniczyć w utracie uzębienia.