©P. A. Hasiuk[1], Yu. L. Korobeinikova[2], L. V. Piasetska[1], L. S. Korobeinikov[2],
A. Ye. Demkovych[1], D. V. Kalashnikov[2], S. G. Zubchenko[2]

I. Horbachevsky Ternopil National Medical University[1]
Poltava State Medical University[2]
e-mail: piasetska@tdmu.edu.ya

Assessment of indicators of bone tissue resorption in patients with chronic generalized periodontitis according to the data of cone-beam computer tomography

АНОТАЦІЯ

Summary. One of the criteria for assessing the degree of pathological changes in periodontal tissues is resorption of the bone tissue of the alveolar process of the jaw. However, changes from the vestibular and oral surfaces on a panorama or focused intraoral x-rays are covered by the shadow of the teeth and objectively do not provide an opportunity for accurate diagnosis of pathological changes in periodontal tissues. The only technique that makes it possible to obtain a three-dimensional image of the studied area with minimal exposure is cone-beam computed tomography (CBCT).
The aim of this study – to evaluate bone tissue resorption in the area of frontal teeth of patients with chronic generalized periodontitis according to CBCT data.
Materials and Methods. The study analyzed the resorption of bone tissue in the area of frontal teeth (80 teeth) in patients with chronic generalized periodontitis. The average age of the subjects was 34–44 years. The EzD2009 software and the basic interface to work in the main MPR (multiplenar reformation) option – multiplenar visualization of a three-plane image was used for CBCT analysis, with adjustment of the thickness of the selected layer (TH) from 0.03 mm to 3.0 cm.
Results and Discussion. The results of cone-beam computed tomography revealed a significant difference in the bone resorption rates of the alveolar process of the jaw from the medial, distal, and vestibulo-oral sides.
Conclusions. This indicates that a detailed study of this indicator is an essential factor in the diagnosis of periodontal changes in patients with chronic generalized periodontitis.

Introduction. Periodontitis is one of the most common dental diseases of our time, which is a social problem that leads to tooth loss. Infection of periodontal pockets negatively affects the body as a whole.

In modern dentistry, the treatment of periodontitis is quite successful thanks to the introduction of new methods of diagnosis and treatment [1–3]. Early detection of the disease makes it possible to apply conservative treatment without resorting to surgical intervention. A visual examination is not enough for this; every patient must undergo periodontal tissue diagnostics to determine periodontitis at an early stage [4–6]. Timely diagnostic of diseases and damages of the maxillofacial system, objective evaluation of the results of treatment in the near and distant periods is an urgent problem in modern dentistry [7–9].

The choice of the optimal method of treatment of dental diseases depends on the correct diagnosis, which is based on the understanding of the

problem and the use of additional diagnostic methods [10–12].

Early diagnosis of periodontal pathologies is one of the factors determining the possibility of ensuring a long-term positive result. After all, even after successful treatment, a number of negative complications are noted, which are difficult to detect clinically.

The relevance of this problem is indicated by a significant number scientific researches devoted to the issues of diagnosis, subject to further prosthetics, of patients with chronic generalized periodontitis [8, 13, 14].

Despite the fact that the idea of evaluating soft tissue structures in periodontal tissue diseases by radiography with contrast substances appeared already at the beginning of the century, today, due to their low accuracy, radiological diagnostic methods do not always satisfy practicing doctors, which is the basis for their improvement.

In modern dentistry, the importance of the X-ray research method is steadily increasing, which has been facilitated by progress in the development of computer technology.

The technique of orthopantomography investiћgation has entered everyday practice as a mandatory stage of high-quality primary diagnosis, and modern digital orthopantomographs with a variety of special diagnostic programs make it possible to significantly minimize the radiation load on the patient. However, even this highly informative method of examination of dental patients does not al-

ways allow obtaining all the required amount of diagnostic information [7, 9, 15].

So according to the literature data, the only technique that makes it possible to obtain a three-dimensional image of the studied area with minimal exposure is cone-beam computed tomography (CBCT).

One of the criteria for assessing the degree of pathological changes in periodontal tissues is resorption of the alveolar process bone tissue of the jaw. However, the changes of the vestibular and oral surfaces on the panorama or focused intraoral x-rays are covered by the shadow of the teeth and objectively do not provide an opportunity for accurate diagnosis of pathological changes in the periodontal tissues [13–14, 16].

The aim of the study – to evaluate bone tissue resorption in the area of frontal teeth of patients with chronic generalized periodontitis according to CBCT data. On the basis of CBCT, to investigate the resorption of bone tissue from the medial, vestibular, oral, distal sides of the tooth in patients with chronic generalized periodontitis, with the help of statistical processing, to conduct an analysis of the study of indicators.

Materials and Methods. We used the EzD2009 software and the basic interface to work in the main MPR (multiplenar reformation) option – multiplanar visualization of a three-plane image. For the purpose of detailed study of the object, the function of adjusting the thickness of the selected layer from 0.03 mm to 3.00 cm was used. After that, sonography of the dentition and individual teeth was obtained (Fig. 1).
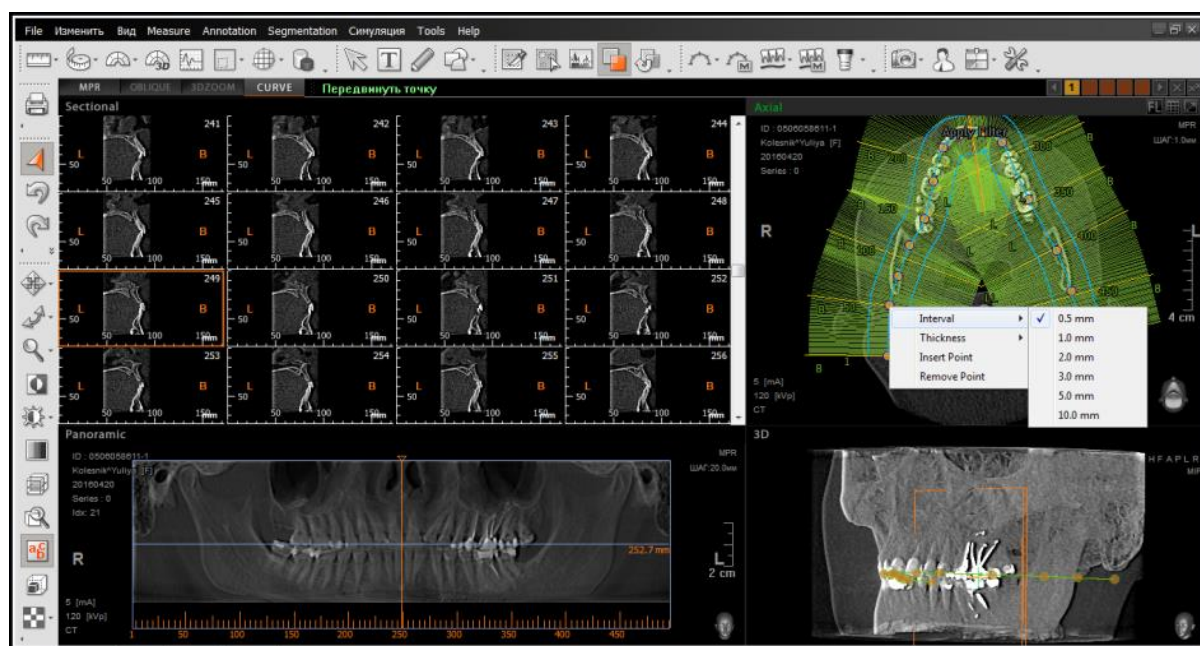

Fig. 1. The basic interface for using MPR (multiplenar reformation) – sonography.

In order to analyze bone tissue resorption from all sides (medial, distal, vestibular and oral) of teeth in patients with chronic generalized periodontitis, the cross-section mode was used (Fig. 2), which allows obtaining a panoramic tomogram in three planes.

The next step was to measure the distance from the crown of the tooth to the bone tissue of the alveolar process on each side (medial, vestibular, oral) using the tape measure tool in the main option of multiplanar imaging. Thus, we analyzed resorption in the area of frontal teeth (80 teeth); the average age of the subjects was 34–44 years.

Results and Discussion. The results obtained during the study were statistically processed using the STATISTICA 6.00 software and presented in the Table .

For the statistical analysis of the obtained data, measures of central tendency were applied: mean, median, mode and dispersion measures, the main of which are: lower and upper quartiles, maximum and minimum, mean squared deviation (confidence SD) and standard error of the mean (St. err.). The chosen level of significance, the margin of error was 0.05, that is, a 5 % chance of rejecting the null hypothesis was assumed, and the reliability of

Fig. 2. Cross-section mode (measurement of resorption from all sides).

Table. General table of cone-beam computed tomography indicators

	Variable	Age	Term	Resoprtion of b.t. M (mm)	Resoprtion of b.t. D (mm)	Resoprtion of b.t. V (mm)	Resoprtion of b.t. O (mm)
Descriptive Statistics	Valid N	83	83	83	83	83	83
	Mean	1974,231	6,627	1,841	1,487	2,867	2,877
	Confidence -95,000 %	1271,321	7,318	1,889	1,535	1,472	1,440
	Confidence +95,000 %	1642,294	7,935	2,793	2,205	2,263	2,315
	Median	1962,000	7,000	1,200	0,900	1,300	0,700
	Minimum	36,0000	6,0000	0,9000	0,7000	0,3000	0,6000
	Maximum	1980,000	14,000	9,300	7,100	7,700	9,200
	Lower Quartile	59,0000	7,0000	1,1000	0,8000	0,3000	0,6000
	Upper Quartile	1967,000	8,000	3,100	2,800	2,700	3,300
	Std. Dev.	849,4685	1,4117	2,0717	1,5334	1,8094	2,0037
	Standard Error	93,24128	0,15496	0,22740	0,16832	0,19861	0,21993

the differences in values was equal to 0.95, or 95 %. Comparisons were made using the Wilcoxon-Mann-Whitney test. Numerical data with a small number of studies were obtained by the method of non-parametric U-test Mann-Whitney analysis for two independent samples.

The following results were obtained evaluating bone resorption indicators according to cone-beam computed tomography data: the average value (mean) of the bone tissue resorption indicator from the medial side was 1.84 mm (St. err. 0.23), with a median equal to 1.20 mm. The minimum indicator of this value was 0.90 mm, and the maximum was 9.30 mm.

The index of bone tissue resorption from the distal side (mean) reached 1.48 mm (St. err. 1.16), and had a median of 0.90 mm and a minimum of 0.70 mm and maximum – 7.10 mm.

The average value (mean) of the indicator of bone tissue resorption from the vestibular side was 2.86 mm (St. err. 0.20), while the minimum of this indicator was 0.3 mm, and the maximum was 7.70 mm. The median value was 1.30 mm.

Determination of the average value of the bone tissue resorption index from the oral side gave a result of 2.87 mm (Std. err. 0.22) with a median equal to 0.7 mm.

Conclusions. The results of cone-beam computer tomography obtained by us show a significant difference in the resorption rates of the bone tissue of the alveolar process of the jaw from the medial, distal and vestibulo-oral sides in the frontal group of teeth. This indicates that a detailed study of this indicator is an essential factor in the diagnosis of periodontal changes in patients with chronic generalized periodontitis.

©**П. А. Гасюк**[1], **Ю. Л. Коробейнікова**[2], **Л. В. Пясецька**[1], **Л. С. Коробейніков**[2],
А. Є. Демкович[1], **Д. В. Калашніков**[2], **С. Г. Зубченко**[2]

Тернопільський національний медичний університет імені І. Я. Горбачевського МОЗ України[1]
Полтавський державний медичний університет[2]

Оцінка показників резорбції кісткової тканини у хворих на хронічний генералізований пародонтит за даними конусно-променевої комп'ютерної томографії

Резюме. Одним із критеріїв оцінки ступеня патологічних змін тканин пародонта є резорбція кісткової тканини альвеолярного відростка щелепи. Проте зміни з боку вестибулярної та оральної поверхонь на панорамних чи сфокусованих внутрішньоротових рентгенограмах перекриваються тінню зубів і об'єктивно не дають можливості точної діагностики патологічних змін у тканинах пародонта. Єдиною технікою, яка дозволяє отримати тривимірне зображення досліджуваної ділянки з мінімальним експонуванням, є конусно-променева комп'ютерна томографія (КПКТ).
Мета дослідження – оцінити резорбцію кісткової тканини в ділянці фронтальних зубів у хворих на хронічний генералізований пародонтит за даними КПКТ.
Матеріали і методи. Проведено аналіз резорбції кісткової тканини в ділянці фронтальних зубів (80 зубів) у хворих на хронічний генералізований пародонтит. Середній вік досліджуваних становив 34–44 роки. Для КПКТ-аналізу використовували програмне забезпечення EzD2009 та базовий інтерфейс для роботи в основній опції MPR (multiplenar reformation) – мультипленарна візуалізація триплощинного зображення з регулюванням товщини виділеного шару від 0,03 мм до 3,0 см.
Результати досліджень та їх обговорення. За результатами конусно-променевої комп'ютерної томографії виявлено достовірну різницю в темпах резорбції кісткової тканини альвеолярного відростка щелепи з медіального, дистального та вестибуло-орального боків.
Висновки. Отримані результати свідчать про те, що детальне вивчення цього показника є суттєвим фактором у діагностиці змін пародонта у хворих на хронічний генералізований пародонтит.

Ключові слова: пародонт; резорбція; томографія; альвеолярний відросток.

LIST OF LITERATURE

1. The effectiveness of the use of polypeptide drugs and their effect on the metabolic parameters of oral fluid in patients with generalized periodontitis in depending on blood type / Y. Bandrivsky, O. Bandrivska, N. Malko [et al.] // Pharmacia. – 2022. – No. 69 (2). – P. 429–435. DOI: 10.3897/pharmacia.69.e82421.

2. Dynamics of changes of C-reactive protein level in blood serum in the development and course of experimental periodontitis and their correction by flavonol / A. Demkovych, P. Hasiuk, Y. Korobeinikova [et al.] // Wiadomosci lekarskie (Warsaw, Poland:1960). – 2022. – No. 75 (2). – P. 451–455.

3. State of collagenolysis in experimental periodontitis of bacterial-immune genesis and its correction with Flavonol / A. Demkovych, Y. Bondarenko, O. Fastovets [et al.] // Medicni perspektivi. – 2021. – No. 26 (2). – P. 26–32. DOI: 10.26641/2307-0404.2021.2.234488.

4. Clinical and CBCT-based diagnosis of furcation involvement in patients with severe periodontitis / M. M. Cimbaljevic, R. R. Spin-Neto, V. J. Miletic [et al.] // Quintessence international (Berlin, Germany : 1985). – 2015. – No. 46 (10). – P. 863–870. DOI: 10.3290/j.qi.a34702.

5. Comparative assessment of the state of bone resorption in patients with chronic generalized periodontitis according to orthopantomogram and cone-beam computed tomography / P. Hasiuk, Y. Korobeinikova, A. Vorobets [et al.] // Polski merkuriusz lekarski: organ Polskiego Towarzystwa Lekarskiego. – 2021. – No. 49 (292). – P. 286–289.

6. Lysokon Y. Analysis of the results of treatment of destructive forms of apical periodontitis with osteotropic drugs in a short term / Y. Lysokon, Y. L. Bandrivsky, M. A. Luchynskyi // Wiadomosci lekarskie (Warsaw, Poland: 1960). – 2022. – No. 75 (1, pt. 2). – P. 228–231. DOI: 10.36740/WLek202001123.

7. Features of occlusal correlations of molars in the dental clinic / P. A. Hasiuk, A. B. Vorobets, A. Y. Demkovych [et al.] // Wiadomosci lekarskie (Warsaw, Poland: 1960). – 2021. – No. 74 (5). – P. 1130–1133. DOI: 10.36740/WLek202105115.

8. Nasseh I. Cone Beam Computed Tomography / I. Nasseh, W. Al-Rawi // Dental clinics of North America. – 2018. – No. 62 (3). – P. 361–391. DOI: 10.1016/j.cden.2018.03.002.

9. Wear resistance of dental materials which are used for anterior teeth restorations / I. V. Yanishen, I. M. Tkachenko, P. M. Skrypnikov, P. A. Hasiuk // Wiadomosci lekarskie (Warsaw, Poland: 1960). – 2020. – No. 73 (8). – P. 1677–1680.

10. Perception of anatomical structures in digitally filtered and conventional panoramic radiographs: a clinical evaluation / B. G. Baksi, E. Alpöz, E. Sogur, A. Mert // Dento maxillo facial radiology. – 2010. – No. 39 (7). – P. 424–430. DOI: 10.1259/dmfr/30570374.

11. Fuentes R. Panoramic radiographs: An invaluable tool for the study of bone and teeth components in the maxillofacial region / R. Fuentes, A. Arias, E. Borie-Echevarría // International Journal of Morphology. – 2021. – No. 39 (1). – P. 268–273.

12. The subjective image quality of direct digital and conventional panoramic radiography / F. Gijbels, A. M. De Meyer, C. Bou Serhal [et al.] // Clinical oral investigations. – 2000. – No. 4 (3). – P. 162–167. DOI: 10.1007/s007840000059.

13. Preeja R. Importance of Radiographs In Conservative Dentistry - A Review / R. Preeja, D. J. Mahalakshmi, L. Arivarasu // European Journal of Molecular&Clinical Medicine. – 2020. – No. 7 (1). – P. 3182–3190.

14. Pritchard B. Anatomy in panoramic image interpretation / B. Pritchard, F. Akbarian Tefaghi, J. Makdissi // British dental journal. – 2020. – No. 228 (4). – P. 229. DOI: 10.1038/s41415-020-1324-1.

15. Sex differences of odontometrical indexes crowns of molars / P. Hasiuk, A. Vorobets, N. Hasiuk [et al.] // Interventional medicine & applied science. – 2017. – No. 9 (3). – P. 160–163. DOI: 10.1556/1646.9.2017.08.

16. Comparative Analysis of the Temporomandibular Joints in Patients with Chronic Periodontitis Using Cone-Beam Computed Tomography (CBCT) / X. Guo, C. Yang, J. Wang [et al.] // Advances in therapy. – 2021. – No. 38 (1). – P. 541–549. DOI: 10.1007/s12325-020-01508-6.

REFERENCES

1. Bandrivsky, Y., Bandrivska, O., Malko, N., Posolenyk, L., Vydoinyk, O., & Iskiv, M. (2022). The effectiveness of the use of polypeptide drugs and their effect on the metabolic parameters of oral fluid in patients with generalized periodontitis in depending on blood type. *Pharmacia, 69*(2), 429-435. DOI: 10.3897/pharmacia.69.e82421.

2. Demkovych, A., Hasiuk, P., Korobeinikova, Y., Shcherba, V., & Korobeinikov, L. (2022). Dynamics of changes of C-reactive protein level in blood serum in the development and course of experimental periodontitis and their correction by flavonol. *Wiadomosci lekarskie* (Warsaw, Poland:n 1960), *75*(2), 451-455.

3. Demkovych, A., Bondarenko, Y., Fastovets, O., Hrad, A., Hasiuk, P., & Denefil, O. (2021). State of collagenolysis in experimental periodontitis of bacterial-immune genesis and its correction with Flavonol. *Medicni perspektivi, 26*(2), 26-32. DOI: 10.26641/2307-0404.2021.2.234488.

4. Cimbaljevic, M.M., Spin-Neto, R.R., Miletic, V.J., Jankovic, S.M., Aleksic, Z.M., & Nikolic-Jakoba, N.S. (2015). Clinical and CBCT-based diagnosis of furcation involvement in patients with severe periodontitis. *Quintessence international* (Berlin, Germany:1985), *46*(10), 863-870. DOI: 10.3290/j.qi.a34702.

5. Hasiuk, P., Korobeinikova, Y., Vorobets, A., Korobeinikov, L., Dzetsiukh, T., Rosolovska, S., & Gurando, V. (2021). Comparative assessment of the state of bone resorption in patients with chronic generalized periodontitis according to orthopantomogram and cone-beam computed tomography. *Polski merkuriusz lekarski : organ Polskiego Towarzystwa Lekarskiego, 49*(292), 286-289.

6. Lysokon, Y., Bandrivsky, Y.L., & Luchynskyi, M.A. (2022). Analysis of the results of treatment of destructive forms of apical periodontitis with osteotropic drugs in a short term. *Wiadomosci lekarskie* (Warsaw, Poland: 1960), *75*(1, pt. 2), 228-231. DOI: 10.36740/WLek202001123.

Ортопедична стоматологія

7. Hasiuk, P.A., Vorobets, A.B., Demkovych, A.Y., Tkachenko, I.M., Klitynska, O.V., Rosolovska, S.O., & Pyasetska, L.V. (2021). Features of occlusal correlations of molars in the dental clinic. *Wiadomosci lekarskie* (Warsaw, Poland: 1960), *74*(5), 1130-1133. DOI: 10.36740/WLek202105115.

8. Nasseh, I., & Al-Rawi, W. (2018). Cone Beam Computed Tomography. *Dental clinics of North America*, *62*(3), 361-391. DOI: 10.1016/j.cden.2018.03.002.

9. Yanishen, I.V., Tkachenko, I.M., Skrypnikov, P.M., & Hasiuk, P.A. (2020). Wear resistance of dental materials which are used for anterior teeth restorations. *Wiadomosci lekarskie* (Warsaw, Poland: 1960), *73*(8), 1677-1680.

10. Baksi, B.G., Alpöz, E., Sogur, E., & Mert, A. (2010). Perception of anatomical structures in digitally filtered and conventional panoramic radiographs: a clinical evaluation. *Dento maxillo facial radiology*, *39*(7), 424-430. DOI: 10.1259/dmfr/30570374.

11. Fuentes, R, Arias, A, & Borie-Echevarría, E. (2021). Panoramic radiographs: An invaluable tool for the study of bone and teeth components in the maxillofacial region. *International Journal of Morphology*, *39*(1), 268-273.

12. Gijbels, F., De Meyer, A.M., Bou Serhal, C., Van den Bossche, C., Declerck, J., Persoons, M., & Jacobs, R. (2000). The subjective image quality of direct digital and conventional panoramic radiography. *Clinical oral investigations*, *4*(3), 162-167. DOI: 10.1007/s007840000059.

13. Preeja, R., Mahalakshmi, D.J., & Arivarasu, L. (2020). Importance of Radiographs In Conservative Dentistry - A Review. *European Journal of Molecular&Clinical Medicine*, *7*(1), 3182-3190.

14. Pritchard, B., Akbarian Tefaghi, F., & Makdissi, J. (2020). Anatomy in panoramic image interpretation. *British dental journal, 228*(4), 229. DOI: 10.1038/s41415-020-1324-1.

15. Hasiuk, P., Vorobets, A., Hasiuk, N., Rosolovska, S., Bodnarchuk, I., & Radchuk, V. (2017). Sex differences of odontometrical indexes crowns of molars. *Interventional medicine & applied science, 9*(3), 160-163. DOI: 10.1556/1646.9.2017.08.

16. Guo, X., Yang, C., Wang, J., Zhao, M., Li, Y., & Wang, L. (2021). Comparative Analysis of the Temporomandibular Joints in Patients with Chronic Periodontitis Using Cone-Beam Computed Tomography (CBCT). *Advances in therapy, 38*(1), 541-549. DOI: 10.1007/s12325-020-01508-6.