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Densitometric assessment in the justification of rehabilitation of patients with atrophy of the bone tissue of the mandible, on the right side

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CONFLICT OF INTEREST

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Densitometric methods for determining bone density are increasingly becoming fundamental in research and a priority in clinical applications in medical practice. Rehabilitation of patients with bone atrophy becomes impossible without assessing its density and, at the same time, is an important component in the diagnosis and planning of reconstructive surgery, in particular, prognosticity in the use of osteoplastic materials or osteointegration of dental implants. The aim of the study was to conduct a densitometric assessment to substantiate the rehabilitation of patients with atrophy of the mandible, on the right side, in the age groups of 25 to 75 years. Computed tomography digital scan scans obtained using the Vatech PaX-I 3D Green extra-oral radiography system and processed by the standardized X-ray diagnostic software Ez3D-I Original ver. 5.1.9.0. Using the tools of the horizontal option panel, in particular the keys of the interface "profile", the density of bone tissue with interpretation in conventional units of grayness (CUG) in the projection of 4.6, 4.7 teeth was investigated. To obtain qualitatively homogeneous values, we used nonparametric methods of statistical analysis of comparison of age groups - using the multidimensional Kruskal-Wallis test as an alternative intergroup analysis of variance, for simultaneous comparison of three samples. It is proved that during the statistical analysis of bone density using the Mann-Whitney U test in the studied areas of the mandible on the right, the total average number of M experimental (E) groups compared to the average number of the control group (C), high reliability in vertical (VP) measurements and confirmed $p < 0.05$. Thus, it is proved that the early loss of the masticatory group of teeth, in the first group of studies (25-45 years), leads to high rates, with increasing bone density in the direction of distalization of the final defect of the dentition. Conversely, the lack of functional action on bone tissue in the second (46-60 years) and third (61-75 years) groups of the study, leads to a decrease in its density, and, consequently, to the devastation of the trabecular layer, which contributes to the progression of atrophic processes.

Keywords: mandible, computed tomography, densitometry, bone atrophy.

Introduction

X-ray densitometry is one of the most advanced and diagnostic-informative method of studying bone density [1, 19, 28]. Widespread use [18, 32] and ranges of modifications regulate the possibilities in the study of complex morphological structures [9]. Dynamic observation is easily accessible thanks to digital methods of X-ray anatomical CT, which is much broader than conventional clinical radiology, provide a rapid result of the study of the dynamic bone system [13], which depends on metabolic processes and internal and external factors. environment, causing its pathological and morphological changes,

including taking into account its structural topographic features. As a result of such implementations, densitometric determination of bone density, which is a depot of micro- and macroelements of the body, is becoming fundamental in various medical fields of clinical practice [5, 27].

The same assessment of bone mineral density can be performed using ultrasonic densitometry [14], but the difficulty in obtaining three-dimensional models sometimes limits its use.

To understand and assess the bone tissue of the jaws [7], the authors recommend a study of bone density with the

inclusion of cortical and trabecular layers [26], changes in which can be valuable indicators of its biomechanical potential, as described in these works [17, 22].

In direct proportion, the density of bone tissue is reflected in the success of the plan and subsequent surgical treatment of atrophy of the bone tissue of the jaws, with the possible use of osteoplastic materials and, in turn, osteointegration of dental implants. Therefore, rehabilitation of patients with bone atrophy becomes impossible without assessing its density, at the same time, an important component in the diagnosis and planning of reconstructive surgery and prediction of the desired results [26, 33].

X-ray densitometry remains an equally important early diagnostic criterion for detecting the effects of somatic pathology, in particular, endocrine, which leads to the devastation of the trabecular layer or, conversely, its corticalization [4, 23, 29].

The combination of methods for assessing the relationship between morphology, volume and density of bone tissue [4] prevents the possible consequences such as changes in occlusion and facial shape, speech disorders, difficulty in chewing food and social rehabilitation in general.

The available modern review of the literature provides a proper statement on the above issues, and has become an impetus for careful study and a fundamental support for this research.

The aim of the study was to conduct a densitometric assessment to substantiate the rehabilitation of patients with atrophy of the mandible, on the right side, in the age groups of 25 to 75 years.

Materials and methods

Using the Vatech PaX-I 3D Green extra-oral radiography system with a scan size range of 16x9 cm, minimizing the possibility of artifacts caused by patient movement, a 0.5 mm focal spot (IEC60336) on a 14-bit gray scale with a size of 0.2/0.3 voxel and due to the short scan time, high quality images are obtained. 68 scans have been selected that provide the best opportunities for diagnosis and are informative in achieving the goal of this work. The analysis

of computed tomographic digital scans was performed using computer technology HEWLETT-SNCPUM1 with 16.0 GB of RAM, system software 10 Pro for Workstations, 2019: 00391-70000-00000-AA425 and standardized X-ray diagnostic software Ez3D-I Original ver.5.1.9.0, used for visualization of multimodal and multidimensional images. Using the tools of the horizontal option panel, in particular the keys of the interface "profile", the density of bone tissue with interpretation in conventional units of grayness (CUG) in the projection of 4.6, 4.7 teeth was studied (Fig. 1).

The material was divided according to the age of patients into four groups, namely: the first group (I) - 25-45 years, the second group (II) - 46-60 years, the third group (III) 61-75, the fourth group (IV) - 25-75 years old, persons with preserved dentition (control group).

All studies were performed after patients were informed and signed an informed consent to participate in studies in compliance with the basic provisions of the GSR (1996), the Council of Europe Convention on Human Rights and Biomedicine (04.04.1997), the Helsinki Declaration of the World Medical Association on Ethical Principles of Medical Research with human participation (1964-2013), orders of the Ministry of Health of Ukraine № 690 of 23.09.2009, № 616 of 03.08.2012 and approved by the decision of the **Commission on Biomedical Ethics** (Minutes № 2 of 21.10.2021).

The work is a fragment of the initiative research work of the Department of Histology, Cytology and Embryology of Bukovinian State Medical University "Structural and functional features of tissues and organs in ontogenesis, patterns of variant, constitutional, sex-age and comparative morphology of human", № state registration 0121U11012.

Digital statistical analysis was performed in StatSoft Statistica 10.0 software and presented as $M \pm \sigma$ (mean and standard deviation). Using non-parametric methods of statistical analysis, the comparison of experimental groups with the control group was performed using the Mann-Whitney U-test. Comparison of age groups - using the multidimensional Kruskal-Wallis test as an alternative intergroup analysis of variance used to compare three or

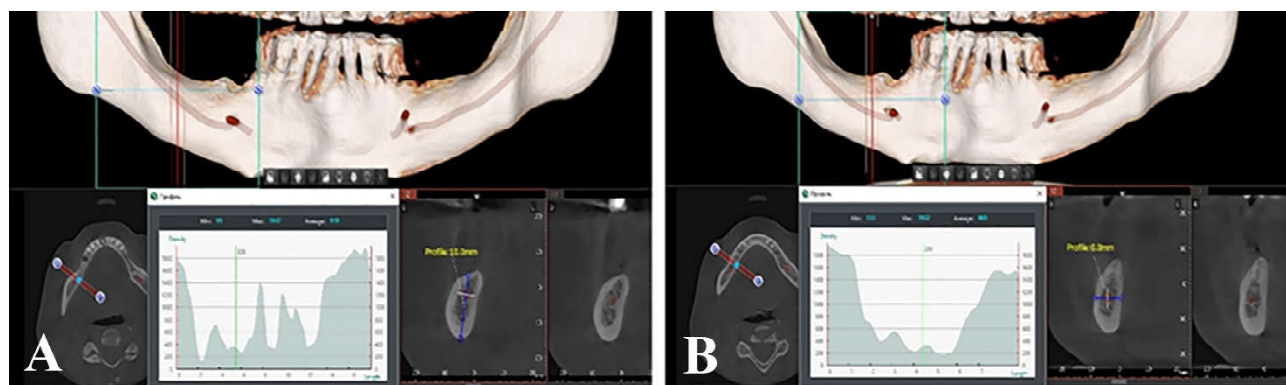


Fig. 1. Densitometric determination of bone density. A - distance, in the vertical plane on sagittal sections, from the edge of the pars alveolaris to the edge of the base of the mandible (VP); B - distance, in the horizontal plane on the sagittal sections, from the edge of the lingual surface to the edge of the buccal surface (HP).

more samples to test null hypotheses according to which different samples were taken from the same distribution with similar medians. Differences between groups were considered significant at a significance level of $p < 0.05$.

Results

The obtained results of densitometric determination indicate a decrease in bone density, with the loss of the masticatory group of teeth, in all study groups. Detailed analysis shows a decrease in the mean value of M in the projections of missing 4.6 and 4.7 teeth in vertical (VP) and horizontal (HP) determinations in the three experimental groups (Table 1).

Table 1. Quantitative indicators of densitometric determination (CUG) of mandibular bone on the right side, on sagittal sections in vertical (VP) and horizontal (HP) planes due to loss of masticatory teeth in people aged 25-75 years ($M \pm \sigma$).

Research groups, years	Projection of 4.6 teeth		Projection of 4.7 teeth	
	VP	HP	VP	HP
I (25-45 p.) n=14	880.6 $\pm$ 142.9	1159 $\pm$ 176	980.1 $\pm$ 144.4	1140 $\pm$ 206
II (46-60 p.) n=20	812.9 $\pm$ 242.4	1064 $\pm$ 148	891.5 $\pm$ 193.6	1042 $\pm$ 148
III (61-75 p.) n=17	783.8 $\pm$ 205.3	947.0 $\pm$ 176.0	778.8 $\pm$ 213.6	893.8 $\pm$ 148.0
p	0.359	0.002	0.009	0.000

With increasing of age, bone density decreases in direct proportion to the loss of masticatory teeth, which is confirmed by high reliability, at a level of significance $p < 0.05$, intergroup differences in values obtained, except VP in the projection of missing 4.6 teeth, where $p > 0.05$ (Fig. 2).

This result is justified by the fact that the cortical layer of bone tissue of the buccal side is primarily affected by etiopathological factors, even with preserved dentition [6].

As well as the physiological process - bone remodeling, primarily occurs on endosteal surfaces, where the most localized osteoclasts and osteoblasts [10, 24].

By comparing the quantitative indicators of densitometric determination (CUG) of bone density, using the Mann-Whitney U-test, in the studied areas of the mandible, the total average number of M experimental (E) groups to the average number of control group (C), the reliability of such results in vertical definitions and is confirmed by $p < 0.05$ (Table 2).

The VP value in projection 4.6 is characterized by a moderately high density in the experimental groups (E) and is 822.0 $\pm$ 236.7 with a decrease in the control group (C) to 675.5 $\pm$ 358.7 ($p < 0.05$). The value of VP in the projection of missing 4.7 teeth indicates a decrease in bone density, both in the experimental groups (E) - 878.0 $\pm$ 233.2 and in the control group (C) - 725.1 $\pm$ 456.4 ($p < 0.05$).

This analysis of the results of VP and HP, although confirms the hypothesis of dependence on the constitutional type of person, but its density is directly proportional to the

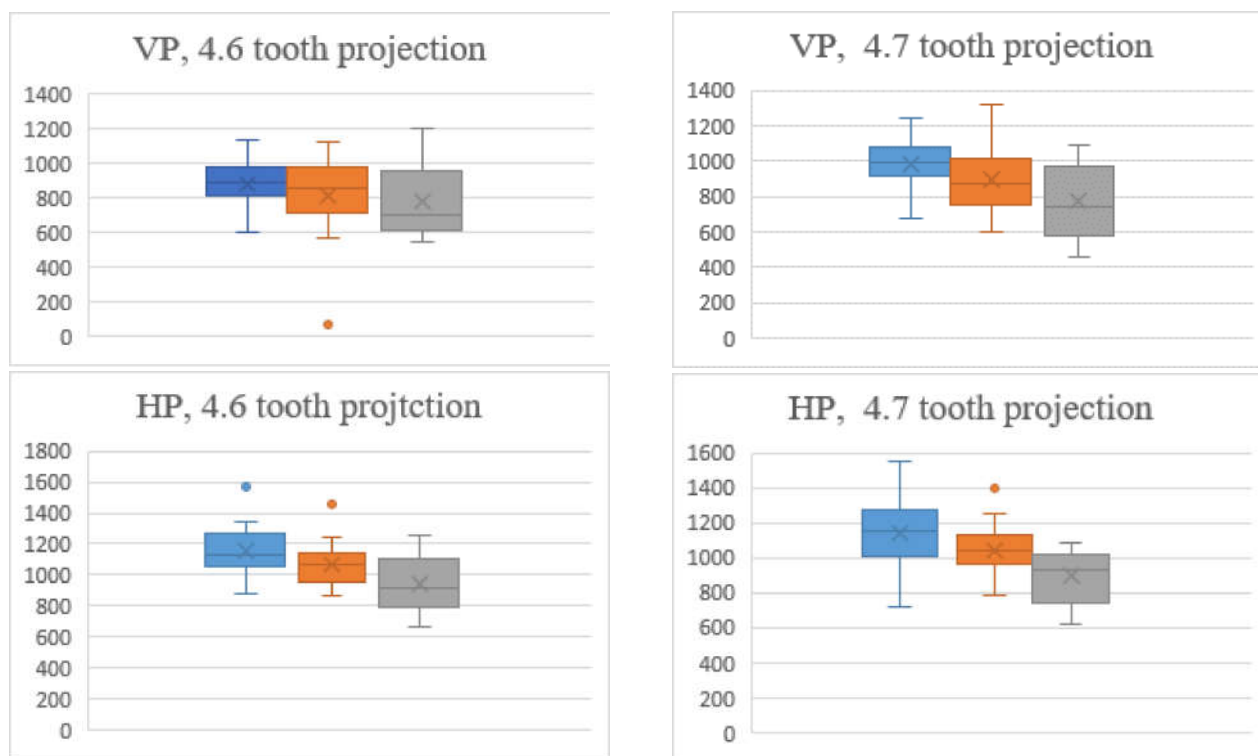


Fig. 2. The level of reliability (p) of the results of densitometric determination: ■ - I research group (25-45 years), where n=14; ■ - II research group (46-60 years), where n=20; ■ - III research group (61-75 years), where n=17.

Table 2. Comparison of quantitative indicators of densitometric determination (CUG) of mandibular bone tissue on sagittal sections in vertical (VP) and horizontal (HP) planes due to loss of masticatory teeth in people aged 25-75 years (n=68).

Definition area		VP		HP	
		M±σ	p	M±σ	p
Projection of 4.6 teeth	E	822.0±236.7	0.004	1051±214	0.300
	C	675.5±358.7		977.4±388.4	
Projection of 4.7 teeth	E	878.0±233.2	0.023	1019±223	0.428
	C	725.1±456.4		959.3±446.1	

Notes: E - experiment; C - control.



Fig. 3. 3D reconstruction models of coronal (frontal) sections of the mandible, with atrophy of bone tissue due to loss of masticatory teeth. A - the first age group (I, 25-45 years); B - the second age group (II, 46-60 years); C - the third age group (III, 61-75 years).

time of tooth loss. After all, we found that the early loss of the masticatory group of teeth, the first group of studies (25-45 years), leads to high rates, with increasing bone density in the direction of distalization of the final defect of the dentition. Conversely, the lack of functional effect on bone tissue, the second (46-60 years) and third (61-75 years) of the study group, leads to a decrease in its density, and consequently the devastation of the trabecular layer, which contributes to the progression of atrophic processes (Fig. 3).

Discussion

The study of bone density is one of the priority diagnostic methods in the rehabilitation protocol of patients with acquired atrophy of bone tissue with secondary defects of the dentition. After all, bone tissue, in particular lower jaw pars alveolaris, is characterized by pronounced morphological variability and has a unique ability to rearrange in the direction of vertical movement of the teeth [30].

Low bone density is characterized by rapid metabolic metabolism, which leads to increased manifestations of pathological changes. Dense trabeculation in the periapical mandibular molars, with well-mineralized trabeculae and small intertrabecular spaces, is a reliable sign of normal skeletal bone density, while sparse trabecular pattern indicates osteopenic manifestations and difficulty in selecting treatment.

The authors [8] point out that the rate of lower jaw bone remodeling is twice as high as in the upper jaw, and, hypothetically, may play a role in the development of osteonecrosis of the jaw, which occurs mainly in the mandibular pars alveolaris due to the pronounced density of cortical layers.

Significant densitometric differences are obtained in the analysis of functional or bone tissue "without activity". Bone mass is conditionally redistributed from one place to another, where force acts [2, 3, 12, 16]. Liquid trabeculation of the mandible (large intertrabecular spaces and thin trabeculae)

is a reliable sign of osteopenia [22, 25]. Decreases in osteoblast-osteocyte-forming cells, which maintain the level of ionic concentration in the bone interstitial fluid, directly reflect the osteon structure and its volume.

In our previous studies [20], as well as the authors [31] focused on the fact that the lack of indirect "constant pressure" leads bone tissue to a state of relative metabolic rest, but also to its devastation, which we confirm in the interpretation of the results II and III experimental groups of this work, presented above.

Having an understanding of bone density, even with severe atrophy of the cell process, or even its complete resorption, the clinical prognosis becomes clear and receptive to the choice of methods of clinical rehabilitation [11]. Loss of bone width and depth can affect implantation success. Directed (controlled) regeneration (DCR) techniques are often used to restore sufficient bone volume for dental implants, but correct implementation of a modern clinical protocol without densitometric analysis becomes impossible and risky [15]. In previous scientific works, the clinical results of rehabilitation of a patient with dentition defects are clearly presented, in particular, on the example of the mandibular segment [21], which became the basis for further research and writing a scientific paper.

Of course, we, like every researcher, sought to compare the results obtained with acquired atrophy of bone tissue

due to loss of the masticatory group of teeth with age, however, the search for similar studies was not effective. Therefore, the prospects for further research include a detailed analysis of age densitometric assessment of bone tissue, as an interdependent diagnostic criterion in the rehabilitation of patients with early loss of the masticatory group of teeth.

Conclusions

1. The cortical layer of bone tissue on the buccal side is primarily affected by etiopathological factors, even with

preserved dentition. Bone remodeling primarily occurs on endosteal surfaces.

2. The density of bone tissue is directly proportional to the time of tooth loss and manifests its variability in the age periods of ontogenetic development. With increasing of age, the bone density of the mandible decreases with end defects of the dentition, which is confirmed by the high intergroup difference of the obtained values, except for the study area in the projection of missing 4.6 teeth in the vertical plane as the area of this definition borders on functionally loaded and is provided with relatively proper mineralization.

References

- [1] Abdelmohsen, A. M. (2017). Comparison of central and peripheral bone mineral density measurements in postmenopausal women. *Journal of Chiropractic Medicine*, 16(3), 199-203. doi: 10.1016/j.jcm.2017.08.001
- [2] Bouchard, A. L., Dsouza, Ch., Julien, C., Rummier, M., Gaumont, M.-H., Cermakian, N., & Willie, B. M. (2022). Bone adaptation to mechanical loading in mice is affected by circadian rhythms. *Bone*, (154), 116218. doi: 10.1016/j.bone.2021.116218
- [3] Evensen, E., Skeie, G., Wilsgaard, T., Christoffersen, T., Dennison, E., Furberg, A.-S., ... & Emaus, N. (2018). How is adolescent bone mass and density influenced by early life body size and growth? The Tromsø Study: Fit Futures - A longitudinal cohort study from Norway. *JBMR*, 2(5), 268-280. doi: 10.1002/jbm4.10049
- [4] Farzanegan, F., Zarch, S. H. H., Mobasheri, M. F., & Rangrazi, A. (2019). Evaluation of the Relationship Between Morphology, Volume, and Density of the Mandible and Dentofacial Vertical Dimension Using Cone Beam Computed Tomography. *Pesqui. Bras. Odontopediatria Clin. Integr.*, 19(1), 1-8. doi: 10.4034/PBOCI.2019.191.128
- [5] He, J., Xu, S., Zhang, B., Xiao, Ch., Chen, Z., Si, F., ... Chen, J. (2020). Gut microbiota and metabolite alterations associated with reduced bone mineral density or bone metabolic indexes in postmenopausal osteoporosis. *Aging* (Albany NY), 12(9), 8583-8604. doi: 10.18632/aging.103168
- [6] Heimes, D., Schiegnitz, E., Kuchen, R., Kämmerer, P. W., & Al-Nawas, B. (2021). Buccal Bone Thickness in Anterior and Posterior Teeth-A Systematic Review. *Healthcare* (Basel), 9(12), 1-33. doi: 10.3390/healthcare9121663
- [7] Hutchinson, E. F., Farella, M., Hoffman, J., & Kramer, B. (2017). Variation in bone density across the body of the immature human mandible. *Journal of Anatomy*, 230(5), 679-688. doi: 10.1111/joa.12591
- [8] Ihnatiev, O. M., Ermolenko, T. O., Turchyn, M. I., Paniuta, O. I., & Prutiiian, T. L. (2020). Маркери метаболізму кісткової тканини: лекції [Markers of bone metabolism: lectures]. *Вісник морської медицини - Bulletin of Marine Medicine*, 2(87), 127-148. doi: 10.5281/zenodo.3976574
- [9] Jankowski, L. G., Warner, S., Gaither, K., Lenchik, L., Fan, B., Lu, Y., & Shepherd, J. J. (2019). Cross-calibration, Least Significant Change and Quality Assurance in Multiple Dual-Energy X-ray Absorptiometry Scanner Environments: 2019 ISCD Official Position. *Clin. Densitom.*, 22(4), 472-483. doi: 10.1016/j.jocd.2019.09.001
- [10] Kawata, K., Narita, K., Washio, A., Kitamura, Ch., Nishihara, T., Kubota, S., & Takeda, S. (2021). Odontoblast differentiation is regulated by an interplay between primary cilia and the canonical Wnt pathway. *Bone*, (150), 116001. doi: 10.1016/j.bone.2021.116001
- [11] Khuder, T., Yunus, N., Sulaiman, E., Ibrahim, N., Khalid, T., & Masood, M. (2017). Association between occlusal force distribution in implant overdenture prostheses and residual ridge resorption. *Journal of Oral Rehabilitation*, 44(5), 398-404. doi: 10.1111/joor.12504
- [12] Kralick, A. E., & Zemel, B. S. (2020). Evolutionary perspectives on the developing skeleton and implications for lifelong health. *Front. Endocrinol.* (Lausanne), (11), 1-11. doi: 10.3389/fendo.2020.00099
- [13] Kuroiedova, V. D., Vyshenko, Ye. Ye., Stasiuk, A. A., Halych, L. B., & Petrova, A. V. (2020). Оптична щільність різних відділів щелеп ортодонтичних пацієнтів в період формування зубощелепної системи [Optical density of different parts of jaws in orthodontic patients during dentofacial development]. *Актуальні проблеми сучасної медицини: Вісник Української медичної стоматологічної академії - Actual Problems of the Modern Medicine: Bulletin of Ukrainian Medical Stomatological Academy*, 3(71), 60-64. doi: 10.31718/2077-1096.20.3.60
- [14] Lukanets, E. Yu. (2021). Оцінка мінеральної щільності кісткової тканини та алгоритмів 10-річного ризику остеопоротичних переломів у жінок [Estimation of bone mineral density and algorithms of 10-year risk of osteoporotic fractures in women]. *Ліку України - Medicines of Ukraine*, 5(251), 31-34. doi: 10.37987/1997-9894.2021.5(251).238139
- [15] Malo, P., de Araujo Nobre, M., Lopes, A., Ferro, A., & Botto, J. (2019). The All on 4 treatment concept for the rehabilitation of the completely edentulous mandible: A longitudinal study with 10 to 18 years of follow-up. *Clin. Implant. Dent. Relat. Res.*, 21(4), 565-577. doi: 10.1111/cid.12769
- [16] Martinez-Rodriguez, A., Sanchez-Sanchez, J., Vicente-Martinez, M., Martinez-Olcina, M., Miralles-Amoros, L., & Sanchez-Saez, J. A. (2021). Anthropometric dimensions and bone quality in international male beach handball players: junior vs. senior comparison. *Nutrients*, 13(6), 1817. doi: 10.3390/nu13061817
- [17] Morgan, E. F., Unnikrisnan, G. U., & Hussein, A. I. (2018). Bone mechanical properties in healthy and diseased states. *Ann. Rev. Biomed. Eng.*, (20), 119-143. doi: 10.1146/annurev-bioeng-062117-121139
- [18] Morse, L. R., Biering-Soerensen, F., Carbone, L. D., Cervinka, T., Ciriigliaro, C. M., Johnston, T. E., & ... Craven, B. C. (2019). bone mineral density testing in spinal cord injury: ISCD official position. *J. Clin. Densitom.*, 22(4), 554-566. doi: 10.1016/j.jocd.2019.07.012
- [19] Ohiomoba, H., Sonis, A., Yansane, A., & Friedland, B. (2017). Quantitative evaluation of maxillary alveolar cortical bone thickness and density using computed tomography imaging. *American Journal of Orthodontics and Dentofacial Orthopedics*, 151(1), 82-91. doi: 10.1016/j.ajodo.2016.05.015

- [20] Oshurko, A. P. (2021). Прогресивність вітчизняних та світових наукових обґрунтувань у реабілітації пацієнтів із атрофією кісткової тканини, ускладненої топографо-анатомічною особливістю каналу нижньої щелепи [Progressiveness of domestic and international scientific researches on patient rehabilitation with bone atrophy complicated by the topographical and anatomical peculiarity of the mandibular canal]. *Вісник проблем біології і медицини - Bulletin of Problems Biology and Medicine*, 162(4), 55-60. doi: 10.29254/2077-4214-2021-4-162-55-60
- [21] Oshurko, A. P., Oliynyk, I. Yu., Yaremchuk, N. I., & Makarchuk, I. S. (2021). Morphological features of bone tissue in "disuse atrophy" on the example of a segment of the human lower jaw: clinical experience of treatment. *Biomedical and Biosocial Anthropology*, (42), 5-11. doi: 10.31393/bba42-2021-01
- [22] Owen, R., & Reilly, G. C. (2018). In vitro models of bone remodelling and associated disorders. *Front. Bioeng. Biotechnol.*, (6), 1-22. <https://doi.org/10.3389/fbioe.2018.00134>
- [23] Ramanauskaitė, A., Becker, K., Kassira, H. C., Becker, J., Sader, R., & Schwarz, F. (2020). The dimensions of the facial alveolar bone at tooth sites with local pathologies: A retrospective cone-beam CT analysis. *Clin. Oral. Investig.*, 24(4), 1551-1560. doi: 10.1007/s00784-019-03057-x
- [24] Remmers, S. J. A., de Wildt, B. W. M., Vis, M. A. M., Spaander, E. S. R., de Vries, R. B. M., Ito, K., & Hofmann, S. (2021). Osteoblast-osteoclast co-cultures: A systematic review and map of available literature. *National Library of Medicine*, 16(11), e0257724. doi: 10.1371/journal.pone.0257724
- [25] Rodionova, S. S., & Khakimov, U. R. (2018). Факторы риска дефицита минеральной плотности костной ткани и низко-энергетического перелома при первичных формах остеопороза у мужчин [Risk factors of bone mineral density deficit and low-energy fractures in primary osteoporosis in men]. *Вестник травматологии и ортопедии имени Н.Н. Приорова - Bulletin of traumatology and orthopedics named after N. N. Priorov*, (1), 22-29. doi: 10.32414/0869-8678-2018-1-22-29
- [26] Rossi, M., Bruno, G., de Stefani, A., Perri, A., & Gracco, A., (2017). Quantitative CBCT evaluation of maxillary and mandibular cortical bone thickness and density variability for orthodontic miniplate placement. *International Orthodontics*, 15(4), 610-624. doi: 10.1016/j.ortho.2017.09.003
- [27] Schafmeyer, L., Linden, T., Sill, H., Rehberg, M., Schoenau, E., & Duran, I. (2022). Pediatric Reference Centiles of Bone Mineral Density and Body Composition of Lower Limbs. *Journal of Clinical Densitometry*, 25(1), 73-80. doi: 10.1016/j.jocd.2021.07.013
- [28] The International Society for Clinical Densitometry (Adult) Official Positions. (2019). 1-35. <https://www.iscd.org/official-positions/2019-iscd-official-positions-adult>
- [29] Tian, L., Yang, R., Wei, L., Liu, J., Yang, Y., Shao, F., ... & Guo T. (2017). Prevalence of osteoporosis and related lifestyle and metabolic factors of postmenopausal women and elderly men: A cross-sectional study in Gansu province, Northwestern of China. *Medicine (Baltimore)*, 96(43), e8294. doi: 10.1097/MD.00000000000008294
- [30] Tsepikolenko, V. O., Pshenychnyi, T. Y., Holiuk, Ye. L., Tymochuk, V. V., & Derkach, R. V. (2021). Використання аутомезоконцентрату тромбоцитів у пацієнтів з патологією опорно-рухового апарату [The Platelet Automesoconcentrate in Patients with Orthopedical Pathology]. *Український журнал медицини, біології та спорту - Ukrainian Journal of Medicine, Biology and Sport*, 29(1), 160-167. doi: 10.26693/jmbs06.01.160
- [31] Whitney, D. G., Hurvitz, E. A., & Caird, M. S. (2021). Critical periods of bone health across the lifespan for individuals with cerebral palsy: Informing clinical guidelines for fracture prevention and monitoring. *Bone*, (150), 116009. doi: 10.1016/j.bone.2021.116009
- [32] Williams, K. M., Darukhanavala, A., Hicks, R., & Kelly, A. (2022). An Update on Methods for Assessing Bone Quality and Health in Cystic Fibrosis. *Journal of Clinical & Translational Endocrinology*, (27), 100281. doi: 10.1016/j.jcte.2021.100281
- [33] Wismeijer, D., & Chen, S. T. (2018). Proceedings of the Sixth ITI Consensus Conference. *Clin. Oral. Impl. Res.*, 29(Suppl. 16), 5-7. doi: 10.1111/clr.13301

ДЕНСИТОМЕТРИЧНА ОЦІНКА В ОБґРУНТУВАННІ РЕАБІЛІТАЦІЇ ПАЦІЄНТІВ ІЗ АТРОФІЄЮ КІСТКОВОЇ ТКАНИНИ НИЖНЬОЇ ЩЕЛЕПИ, З ПРАВОЇ СТОРОНИ

Ошурко А. П.

Методи денситометричного визначення щільності кісткової тканини дедалі частіше стають фундаментальними у наукових дослідженнях та пріоритетними у клінічному застосуванні в медичній практиці. Реабілітація пацієнтів з атрофією кісткової тканини стає неможливою без оцінки її щільності та, водночас, є важливою складовою при діагностиці та плануванні реконструктивного хірургічного втручання, зокрема, прогностичності у використанні остеопластичних матеріалів чи остеointegraції дентальних імплантатів. Метою роботи було проведення денситометричної оцінки для обґрунтування реабілітації пацієнтів з атрофією кісткової тканини нижньої щелепи з правої сторони у вікових групах людей від 25 до 75 років. Отримані з використанням системи екстра-оральної рентгенографії Vatech PaX-I 3D Green комп'ютерно-томографічні цифрові сканування опрацьовано стандартизованим рентгенодіагностичним програмним забезпеченням Ez3D-I Original ver.5.1.9.0. Використовуючи інструменти горизонтальної опційної панелі, зокрема клавіші інтерфейсу "профіль", досліджено щільність кісткової тканини з інтерпретацією в умовних одиницях сірості (УОС) у проекції 4.6 та 4.7 зубів. Для отримання якісно однорідних значень нами застосовано непараметричні методи статистичного аналізу порівняння груп за віком - із використанням багатовимірною критерію Краскела-Уолліса як альтернативного міжгрупового дисперсного аналізу для одночасного порівняння трьох вибірок. Під час статистичного аналізу отриманих показників щільності кісткової тканини з використанням U-критерію Манна-Уїтні в досліджуваних ділянках нижньої щелепи справа, за загальним середнім числом M дослідних (Д) груп у порівнянні із середнім числом групи контролю (К), отримано високу достовірність результатів у вертикальних (VP) замірах і підтверджено $p < 0,05$. Таким чином, доведено, що рання втрата жувальної групи зубів, у першій групі дослідження (25-45 років), призводить до високих показників з наростанням щільності кісткової тканини в бік дисталізації кінцевого дефекту зубних рядів. І, навпаки, відсутність функціональної дії на кісткову тканину, у другій (46-60 років) та третій (61-75 років) групах дослідження, призводить до зниження її щільності, а, відповідно, і до спустошення трабекулярного шару, що сприяє прогресуванню атрофічних процесів.

Ключові слова: нижня щелепа, комп'ютерна томографія, денситометрія, атрофія кісткової тканини.

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