Abstract. According to domestic and foreign authors, the incidence of chronic sinusitis has increased more than 2 times over the past 10 years, and the specific weight of patients hospitalized in ENT – inpatients increases annually by 1.5-2% and has no tendency to decrease. Such information, apparently, is due not to the true ratio of sinusitis of various etiologies, but to the peculiarity of the examination of patients with this pathology in dental and otorhinolaryngological hospitals.

The peak of admissions of patients with odontogenic sinusitis to the Department of Maxillofacial Surgery of Poltava Regional Clinical Hospital occurred in 2019 – 272 (16.7%) cases of sinusitis, the lowest rate of hospitalization was recorded in 2008 – 195 (about 11.9%). The most common diagnosis was: “Exacerbation of chronic odontogenic sinusitis” – 817 (50.2%) cases, which is consistent with the literature data. Patients with the diagnosis: “Acute odontogenic sinusitis” accounted for the minimum rate – 2.4% of cases. Recurrence of sinusitis was observed on average in 2017-2023 in 5.2% of cases. In 19.3% of cases, there was a discrepancy between the diagnosis of the referring institution and the clinical diagnosis. In 2.6% of cases, the clinical diagnosis did not correspond to the described clinical data. 59.2% of patients were referred from dental polyclinics and offices; 15.7% of patients were referred by related specialists (ENT, neurologist); 14.7% went to the hospital themselves; in 10% of cases, data on the sending institution were missing.

The problem of prevention, diagnosis (including differential) and treatment of odontogenic sinusitis is an urgent task of dentistry.

Among the causes of the development of the disease, a significant part is pathological processes, the development of which was facilitated by inadequate medical tactics for the treatment of chronic inflammatory processes in the area of molars of the upper jaw. The use of traditional methods of radical surgical treatment is often accompanied by chronicity of the process.

Key words: nasal cavity, mucous membrane, odontogenic phlegmon, inflammatory disease, maxillofacial area, rhinitis, sinusitis.

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Conflict of interest:
The authors declare no conflict of interest.

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DOI 10.29254/2077-4214-2024-1-172-522-527
UDC 616.314.13/.14-073.75
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ANALYSIS OF HARD TISSUE DENSITY INDICATORS OF PERMANENT TEETH WITH DIFFERENT LOCALIZATION
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Mineral density of bones and teeth is an optimal biomarker that allows assessing their qualitative characteristics. In dental practice, dental radiography is widely used to determine the density of jawbone tissue and hard tissues of teeth. The aim of our study was to elucidate the characteristics and compare the density indicators of hard tissues of the cervical area of formed permanent teeth of different localization.

To determine the density indicators of hard tissues of teeth, X-ray images of 320 intact formed permanent teeth were processed.

It was found that the density of all investigated tissues of teeth of the upper jaw is higher than that of the antagonist teeth of the lower jaw. The density of enamel and dentin of teeth on the right side is higher than that of the
The distribution of cement density is asymmetrical. In all quadrants, the highest density was found for dentin, and the lowest – for cement. A significant difference was established between all compared groups.

The density of enamel, dentin, and cement of teeth in the upper jaw is higher than in the antagonist teeth of the lower jaw. The density of enamel and dentin of teeth on the right side is higher than in the teeth on the left side. The distribution of cement density is asymmetric.

**Key words:** density, enamel, dentin, cement, permanent teeth.
We also conducted pairwise comparisons of enamel, dentin, and cementum density indicators of teeth from different quadrants. In pairwise comparisons of the examined teeth groups, a significant difference in enamel mineral density was found only between the groups of teeth from the first (11-17) and second (21-27) quadrants (p<0.005), first (11-17) and third (31-37) quadrants (p<0.05), second (21-27) and fourth (41-47) quadrants (p<0.05), first (11-17) and fourth (41-47) quadrants (p<0.005), second (21-27) and third (31-37) quadrants (p<0.05), second (21-27) and fourth (41-47) quadrants (p<0.05), no significant differences were found between the groups of teeth from the second (21-27) and third (31-37) quadrants, as well as the first (11-17) and fourth (41-47) quadrants (figure 2).

In pairwise comparisons of tooth groups from different quadrants, a significant difference in dentin density indicators was found between the group of the first (11-17) and third (31-37) quadrants (p<0.005), first (11-17) and fourth (41-47) quadrants (p<0.005), second (21-27) and third (31-37) quadrants (p<0.05), second (21-27) and fourth (41-47) quadrants (p<0.05). No significant differences were found in pairwise comparisons of other tooth groups (figure 3).

The results of pairwise comparisons of tooth groups from different quadrants revealed a significant difference in cementum density indicators between teeth from the first (11-17) and third (31-37) quadrants (p<0.005), second (21-27) and third (31-37) quadrants (p<0.001), second (21-27) and fourth (41-47) quadrants (p<0.05), third (31-37) and fourth (41-47) quadrants (p<0.005). No significant differences were found between the groups of teeth from the first (11-17) and second (21-27) quadrants, as well as the first (11-17) and fourth (41-47) quadrants (figure 4).

Modern scientific medical literature contains numerous studies dedicated to investigating the causes and prerequisites for the occurrence and progression of pathological lesions of hard teeth tissues of both carious and non-carious origins. The analysis of scientific sources indicates the multifactorial nature of tooth tissue pathology. According to various authors, both endogenous and exogenous factors contribute to their development: genetic, bacterial, hygienic, metabolic, occlusal, ecological, harmful habits, etc [11-14]. Peumans M, et al. (2020), Tulek A, et al. (2021) consider that such lesions are most often caused not by a single factor but by a combination of them [15, 16]. According to Matviychuk O.Ya. (2005), one of the leading causes of the development of hard tooth tissue pathology is the uneven distribution of chewing load on the teeth. The author emphasizes that in 98.6% of cases, there is a relationship between non-caries cervical lesions and occlusal pathology, confirming the significance of occlusal disorders as one of the primary causes of non-caries cervical lesions [17, 18]. The results of our research indicate that the density indicators of hard tooth tissues from different quadrants are asymmetrical and significantly differ from each other, which obviously indicates an
asymmetric distribution of load during articulation. In our opinion, the detected difference in the quality of enamel, dentin, and cementum of teeth from different quadrants may be one of the reasons for the occurrence of their pathological lesions.

Conclusions.

The density of enamel, dentin, and cementum of teeth from the upper jaw is higher than that of antagonist teeth from the lower jaw. The density of enamel and dentin of teeth from the right side is higher than that of teeth from the left side. The distribution of cementum density is asymmetric – on the upper jaw, this indicator is higher on the left, while on the lower jaw, it is higher on the right. The highest density was found in the dentin area, while the lowest density was observed in the cementum.

Comparison of the examined indicators using the Kruskal-Wallis method showed a significant difference among all compared groups (p<0.05 for enamel, p<0.01 for dentin and cementum).

Pairwise comparisons of the examined tooth groups revealed significant differences in enamel, dentin, and cementum density indicators between teeth from the first (11-17) and third (31-37) quadrants, second (21-27) and fourth (41-47) quadrants for enamel and cementum density, between teeth from the second (21-27) and third (31-37) quadrants for enamel and dentin density, between teeth from the first (11-17) and second (21-27) quadrants for enamel density, and between teeth from the first (11-17) and fourth (41-47) quadrants for dentin density.

Prospects for further research.

Studying the patterns of the relationship between the density indicators of hard tissues of formed permanent teeth from different groups will enable us to understand the distribution characteristics of articulation load on teeth of different functional groups and different localization and develop methodologies for its regulation. In turn, the uniform distribution of articulation, particularly chewing load, will prevent the development of a number of pathological processes of teeth, periodontium, as well as temporomandibular joint and masticatory muscles.

References

1. Hasyuk AP, Novosel'tseva TV, Royko NV, Pyasarenko EA. Strukturno-biokhimichna orhanizatsiya dentyny. Visnyk problem biolohiyi ta medytsyny. 2014;4(3)(115):11-15. [in Ukrainian].
2. Vorobets' AB, Hasyuk PA, Kostyrenko OP. Osoblyvosti strukturnoi orhanizatsiui navkolopol'parhnoho dentynu velykych kutnikh zubiv zalezhno vid stati. Klinichna stomatologiya. 2016;15-10. [in Ukrainian].
3. Hurtova YAM, Shnader SA, Breus VYE, Ulyanov VO. Osoblyvosti khimichnoho skladu emali postiynykh ikiv liudyny. Intehratyvna antropolohiya. 2018;2(32):48-51. [in Ukrainian].
4. Tiron OI, Kuvalenko VI, Breus VYE, Todorova AV. Iyerarkhiya strukturnykh zubnyx osnovnoy faktor, shcho zuminulyvye anizotropiyi yyi mehanichnykh vlastyvostei. Intehratyvna antropolohiya. 2017;2(30):47-52. [in Ukrainian].
5. Kovalenko VV, Tkachenko IM. Miroelementarnyy sklad i morfolohichni osnovnoy osoblyvosti emali i dentynu. Visnyk problem biolohiyi ta medytsyny. 2015;15(1(49)):223-227. [in Ukrainian].
6. Hasyuk PA, Hasyuk AP, Danyčhenko SI, Hasyuk NV. Morfo- i histohenez osnovnyh stomatolohichnyx khvorob. Tomopil': FOP Parkhin V.V; 2016. 104 s. [in Ukrainian].
7. Khomenko LO, Sorochenko HV. Zmyny khimichnoho skladu emali postiynykh zubiv pid vplyvom suchyx skladov emali i dentynu. Klinichna stomatologiya. 2015;1:120-124. [in Ukrainian].
8. Dakhno LO, Masna ZZ. Osoblyvosti komerkovogo vidrostka verhnih schelepy osob zyroko ykiu za danymy konusno-promenevoi kariyesi. Klinichna stomatologiya. 2018;5(5):6-12. [in Ukrainian].
9. Zabolotna II, Honzyts’ka OS. Suchasni uyavlennya pro etiopatohenez nekarioznoyi patolohiyi zubiv, shcho vynykaye pislya yikh razvitia. Klinichna stomatologiya. 2016;1:5-10. [in Ukrainian].
10. Dakhno LO, Masna ZZ. Strukturno-biokhimichna orhanizatsiya dentyny. Visnyk problem biolohiyi ta medytsyny. 2015;15(1(49)):223-227. [in Ukrainian].
11. Hasyuk PA, Danyčhenko SI, Hasyuk AP, Novosel’ts’ka TV, Royko NV, Pyasarenko EA. Strukturno-biokhimichna orhanizatsiya dentyny. Visnyk problem biolohiyi ta medytsyny. 2014;4(3)(115):11-15. [in Ukrainian].
12. Mazur IP, Suprunovych IM. Utrata tverdyx tkanyn zubiv (nekariozni urazhennya): klinika, diagnostyka. Stomatolohichnyy al’manakh. 2005;3:27-31. [in Ukrainian].
13. Zabolotna II, Honzyts’ka OS. Suchasni uyavlennya pro etiopatohenez nekarioznoyi patolohiyi zubiv, shcho vynykaye pislya yikh razvitia. Klinichna stomatologiya. 2016;1:5-10. [in Ukrainian].
14. Zhu T, Huang Z, Shu X, Zhang C, Dong Z, Peng Q. Functional nanomaterials and their potentials in antibacterial treatment of dental caries. Colloids Surf B Biointerfaces. 2022;218:112761. DOI: 10.1016/j.colsurfb.2022.112761.
15. Peumans M, Politano G, Van Meerbeek B. Treatment of noncarious cervical lesions: when, why, and how. Int J Esthet Dent. 2020;15(1):16-24.
16. Tulek A, Mulic A, Runningen M, Lillemo J, Utheim TP, Khan Q, et al. Genetic Aspects of Dental Erosive Wear and Dental Caries. Int J Dent. 2021;2021:5566733. DOI: 10.1155/2021/5566733.
17. Matviychuk OYA. Vplyv nadlyshkovo navantazhennya oklyuziynych karyesu i urazhennya. Visnyk problem biolohiyi ta medytsyny. 2015;15(1(49)):223-227. [in Ukrainian].
18. Matviychuk OYA. Oklyuziyni porushennya yak odna z pershoprychyn vynyknenya nekarioznyx urazhennya. Visnyk problem biolohiyi ta medytsyny. 2015;15(1(49)):223-227. [in Ukrainian].
Аналіз показників щільності всіх досліджуваних тканин зубів різних квадрантів та порівняння їх між собою за методом Крускала-Уолліса засвідчило наявність істотної різниці між усіма порівнюваними групами (p<0,05 для емалі, p<0,01 для дентину та цементу).

При попарному порівнянні досліджуваних груп зубів істотну різницю між групами зубів першого (11-17) та другого (21-27) квадрантів, першого (11-17) та третього (31-37) квадрантів, другого (21-27) та четвертого (41-47) квадрантів (p<0,05), третього (31-37) та четвертого (41-47) квадрантів.

При попарному порівнянні груп зубів різних квадрантів виявлено істотну різницю показників щільності дентину між групою першого (11-17) та третього (31-37) квадрантів, першого (11-17) та четвертого (41-47) квадрантів, другого (21-27) та третього (31-37) квадрантів, другого (21-27) та четвертого (41-47) квадрантів. Результати проведенного попарного порівняння груп зубів різних квадрантів засвідчили істотну різницю показників щільності цементу між групами першого (11-17) та третього (31-37) квадрантів, другого (21-27) та третього (31-37) квадрантів, другого (21-27) та четвертого (41-47) квадрантів, третього (31-37) та четвертого (41-47) квадрантів. Воїння різниця якості емалі, дентину та цементу зубів різних квадрантів може бути однією з причин виникнення їх патологічних уражень.

Висновки. Щільність емалі, дентину та цементу зубів верхньої щелепи є вищою, ніж у зубів-антагоністів нижньої щелепи, щільність емалі та дентину зубів правової сторони є вищою, ніж у зубів лівої сторони, щільність цементу розподілена асиметрично — на верхній щелепі цей показник вищий зліва, а на нижній — справа (четвертий квадрант). У всіх квадрантах найвищу щільність встановлена в ділянці дентину, ніжнішу щільність мав цемент.

Ключові слова: щільність, емаль, дентин, цемент, постійні зуби.

**ANALYSIS OF HARD TISSUE DENSITY PARAMETERS OF PERMANENT TEETH OF VARIOUS LOCALIZATION**

**Yakymovych D. V., Masna Z. Z.**

**Abstract.** Mineral density of mineralized tissues is an optimal biomarker, allowing the assessment of qualitative characteristics of tissues simultaneously with the determination of their structural and topographical features during radiographic examinations of patients. In dental practice, dental radiography is widely used to determine the density of jawbone tissues and hard tissues of teeth. The aim of our study was to clarify the features and compare the density parameters of hard tissues of the cervical area of formed permanent teeth of different localization.

**Object and research methods.** To determine the density parameters of hard tissues of the cervical area, X-rays of 320 intact formed permanent teeth were processed (n=10 for each permanent bite tooth). The density indices in the cervical area were determined separately for enamel and cement on the proximal and distal surfaces of the teeth, and for dentin — in the area between the tooth cavity and the lateral edge in the projection of the tooth cervix (thus, in this area, the indicator was cumulative for dentin itself and the tissues that overlaid it).

**Research results.** It was found that the density of all investigated tissues of the upper jaw teeth (first and second quadrants) is higher than in the teeth-antagonists of the lower jaw (third and fourth quadrants). The density of enamel and dentin of teeth on the right side (first and fourth quadrants) is higher than in the teeth on the left side (second and third quadrants), while the distribution of cement density is asymmetric — on the upper jaw, this parameter is higher on the left (second quadrant), and on the lower jaw — on the right (fourth quadrant). In all quadrants, the highest density was found in the dentin area, and the lowest density was in the cement. Analysis of the density parameters of all investigated tissues of teeth of different quadrants and their comparison using the Kruskal-Wallis method indicated a significant difference between all compared groups (p<0.05 for enamel, p<0.01 for dentin and cement).

Significant differences in mineral density of enamel were found only between the groups of teeth in the first (11-17) and second (21-27) quadrants, the first (11-17) and third (31-37) quadrants, the second (21-27) and fourth (41-47) quadrants.

Significant differences in dentin density between the groups of teeth of different quadrants were found between the first (11-17) and third (31-37) quadrants, the first (11-17) and fourth (41-47) quadrants, the second (21-27) and third (31-37) quadrants, the second (21-27) and fourth (41-47) quadrants.

Results of the pairwise comparison of tooth groups from different quadrants revealed a significant difference in cement density between teeth of the first (11-17) and third (31-37) quadrants, the second (21-27) and third (31-37) quadrants, the second (21-27) and fourth (41-47) quadrants.
quadrants, the second (21-27) and fourth (41-47) quadrants, the third (31-37) and fourth (41-47) quadrants. The identified differences in the quality of enamel, dentin, and cement of teeth from different quadrants may be one of the reasons for the occurrence of their pathological lesions.

Conclusions. The density of enamel, dentin, and cement of teeth in the upper jaw is higher than that of the teeth-antagonists in the lower jaw. The density of enamel and dentin of teeth on the right side is higher than that of the teeth on the left side. The distribution of cement density is asymmetrical – on the upper jaw, this parameter is higher on the left, and on the lower jaw – on the right. In all quadrants, the highest density was found in the dentin area, while the lowest density was observed in the cement.

Key words: density, enamel, dentin, cement, permanent teeth.

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Received 29.09.2023
Accepted 01.03.2024