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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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

teeth on the left side. 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.*

Connection of the publication with planned research works.

The study was carried out as part of the comprehensive research work of the Department of Normal Anatomy and the Department of Operative Surgery with Topographic Anatomy of Danylo Halytsky Lviv National Medical University "Morphofunctional features of organs in the pre- and postnatal periods of ontogenesis, under the influence of opioids, nutritional supplements, reconstructive surgery and obesity" (state registration number 0120U002129).

Introduction.

It is known that the qualitative characteristics of mineralized tissues depend on the features of their structure and mineral composition [1-4]. Both factors, changing physiologically throughout life or under the influence of pathological factors, cause a certain dynamics of mechanical and physical indicators of bones and teeth – their strength, hardness, elasticity, as well as resistance to pathological lesions [4-7]. The mineral density of mineralized tissues is an optimal biomarker that allows, during various radiographic examinations of patients (radiographic, computer tomographic, cone-beam computer tomographic, ultrasonic densitometric, etc.), simultaneous determination of the qualitative characteristics of the studied tissues, alongside determining their structural and topographic features [8-10]. In dental practice, dental radiography is widely used to determine the density of jawbone tissue and hard tissues of teeth.

The aim of the study.

To elucidate the features and compare the density indicators of hard tissues of the cervical area of formed permanent teeth with different localization.

Object and research methods.

To determine the indicators of hard tissue density of the cervical area, X-ray images of 320 intact formed permanent teeth were processed (n=10 for each permanent tooth). X-ray images were taken using a Siemens dental radiography unit with Trophy Radiology software. The research was conducted at the Dental Medical Center of Danylo Halytsky Lviv National Medical University, and the images were processed using VixWin Pro software. The unit of measurement for tissue density was the conditional unit of grayness (CUG). Density indicators of tissues in the cervical area were determined separately for enamel and cementum on the proximal and distal surfaces of teeth, for dentin – in the area between the tooth cavity and the lateral edge in the projection of the tooth cervix (thus, the indicator in this area was cumulative for dentin itself and the tissues layered on it) **(fig. 1)**.

To assess the conformity of the obtained data to the normal distribution law, were used histogram distribution analysis, asymmetry and kurtosis coefficients, the Shapiro-Wilk criterion. The density indicators of hard tissues of permanent teeth with different localization in terms of distribution characteristics differ from normal, therefore they are presented as Me (25%; 75%), where Me is the median, 25% is the 25th percentile (first quartile), and 75% is the 75th percentile (third quartile). The reliability of the difference between sample means was assessed using non-parametric methods: the Wilcoxon U test (Mann-Whitney) and the Kruskal-Wallis method for comparing multiple samples.

Research results and their discussion.

The results of the comparison of enamel, dentin, and cementum density indicators of formed permanent teeth from different quadrants revealed the following regularities: the density of all studied tooth tissues of the upper jaw (first and second quadrants) is higher than that of the antagonist teeth of the lower jaw (third and fourth quadrants), the density of enamel and dentin of the right side teeth (first and fourth quadrants) is higher than that of the left side teeth (second and third quadrants), the distribution of cementum density is asymmetrical – in the upper jaw, this indicator is higher on the left (second quadrant), and in the lower jaw, it is higher on the right (fourth quadrant) **(table)**. The highest density in all quadrants was found in the dentin area, while the cementum had the lowest density.

The analysis of density indicators of all examined tooth tissues from different quadrants and their comparison using the Kruskal-Wallis method revealed a significant difference among all compared groups ($p<0.05$ for enamel, $p<0.01$ for dentin and cementum) **(table)**.

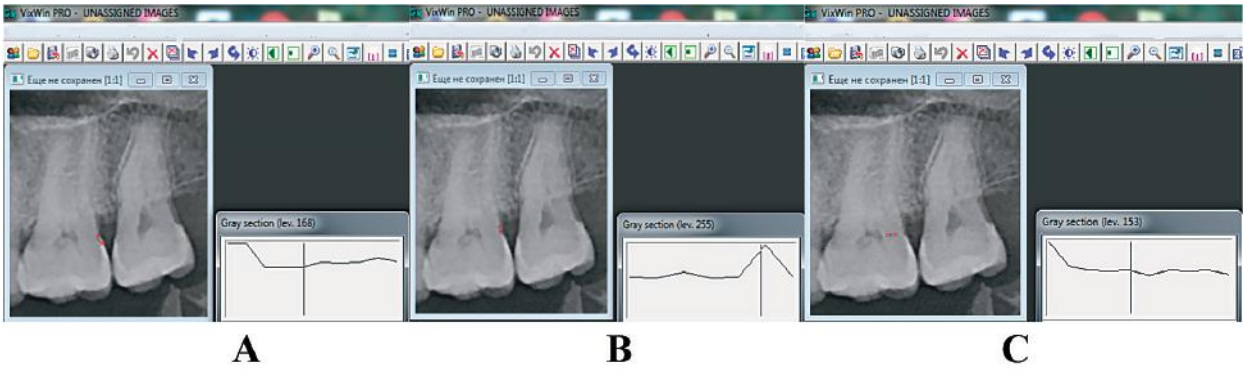

Figure 1 – Algorithm for determining the density of hard tissues of permanent teeth: A – enamel, B – cementum, C – dentin.

Table – Density indicators of hard tissues of permanent teeth from different quadrants

Teeth Tissues	11-17	21-27	31-37	41-47
enamel	149 [127; 165]	132,5 [112; 154]	129,5 [107; 166]	142,5 [119; 166,75]
dentin	157,1 [141; 174]	154,5 [132; 169]	142,5 [125; 163]	146 [125,25; 164]
cementum	124,5 [107,75; 140]	128 [111; 144,75]	113 [99; 128]	122 [108; 137,75]

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 ($p<0.05$), third (31-37) and fourth (41-47) quadrants ($p<0.05$). No significant differences in enamel density indicators 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)**.

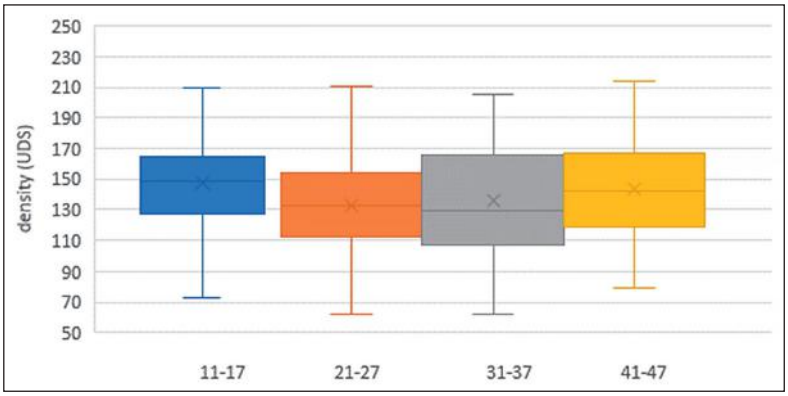

Figure 2 – Comparison of enamel density indicators of permanent teeth from different quadrants.

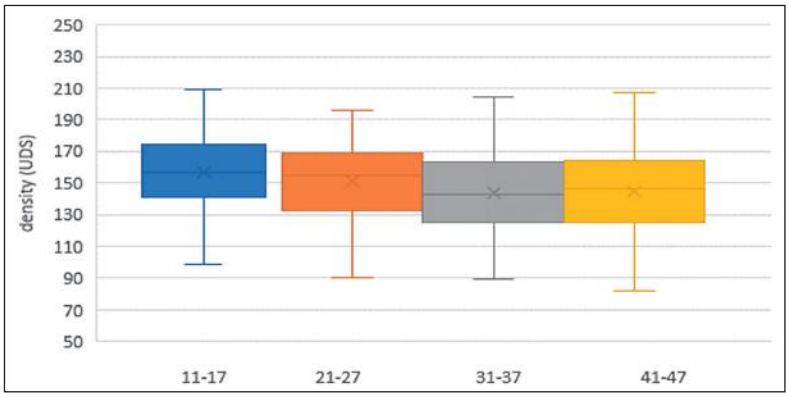

Figure 3 – Comparison of dentin density indicators of permanent teeth from different quadrants.

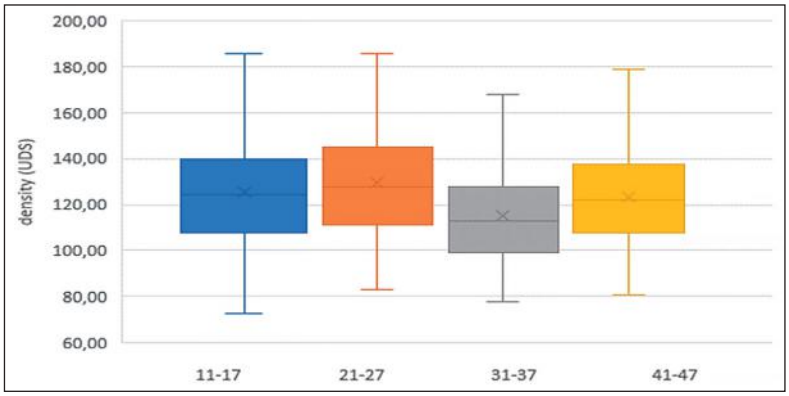

Figure 4 – Comparison of cementum density indicators of permanent teeth from different quadrants.

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-carious cervical lesions and occlusal pathology, confirming the significance of occlusal disorders as one of the primary causes of non-carious 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.

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АНАЛІЗ ПОКАЗНИКІВ ЩІЛЬНОСТІ ТВЕРДИХ ТКАНИН ПОСТІЙНИХ ЗУБІВ РІЗНОЇ ЛОКАЛІЗАЦІЇ

Якимович Д. В., Масна З. З.

Резюме. Мінеральна щільність мінералізованих тканин є оптимальним біомаркером, що дозволяє при проведенні променевих обстежень пацієнтів одночасно з визначенням структурних та топографічних особливостей досліджуваних тканин, оцінити їх якісні характеристики. В стоматологічній практиці для визначення щільності кісткової тканини щелеп та твердих тканин зубів широке застосування має дентальна радіовізіографія.

Метою нашого дослідження стало з'ясування особливостей та порівняння показників щільності твердих тканин пришийкової ділянки сформованих постійних зубів різної локалізації.

Об'єкт і методи дослідження. Для визначення показників щільності твердих тканин пришийкової ділянки було опрацьовано рентгенограми 320 інтактних сформованих постійних зубів (n=10 для кожного зуба постійного прикусу). Показники щільності тканин у пришийковій ділянці визначали окремо для емалі та цементу на проксимальній та дистальній поверхнях зубів, для дентину – у проміжку між порожниною зуба та бічним краєм в проекції шийки зуба (тому в цій ділянці визначений показник був сумарним для власне дентину, та тканин, які на нього нашаровувались).

Результати дослідження. Виявлено, що щільність усіх досліджуваних тканин зубів верхньої щелепи (перший та другий квадранти) є вищою, ніж у зубів-антагоністів нижньої щелепи (третій та четвертий квадранти), щільність емалі та дентину зубів правої сторони (перший та четвертий квадранти) є вищою, ніж у зубів лівої сторони (другий та третій квадранти), щільність цементу розподілена асиметрично – на верхній щелепі цей показник вищий зліва (другий квадрант), а на нижній – справа (четвертий квадрант). У всіх квадрантах найвищу щільність встановлена в ділянці дентину, мінімальну щільність мав цемент.

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 мінеральної щільності емалі було встановлено лише 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 проведеного попарного порівняння груп зубів різних квадрантів засвідчили істотну різницю показників щільності цементу між зубами 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. Воиявлена 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 правої сторони є вищою, ніж у зубів лівої сторони, щільність цементу розподілена асиметрично – на верхній щелепі цей показник вищий зліва, а на нижній – справа. У всіх квадрантах найвища щільність встановлена в ділянці дентину, найнижчу 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, 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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