DOI 10.26724/2079-8334-2021-3-77-220-223
UDC 611.314:616.314.9-053.2(477.87)

O.V. Klitynska, V.V. Shetelya, [1]G.A. Yeroshenko, T.I. Zorivchak, [2]V.I. Struk, [3]T.L. Kotyk, [3]O.G. Popadynets
Uzhhorod National University, Uzhhorod, [1]Poltava State Medical University, Poltava, [2]Bukovinian State Medical University, Chernivtsi, [3]Ivano-Frankivsk National Medical University, Ivano-Frankivsk

STRUCTURAL FEATURES OF DECIDUOUS TEETH IN CHILDREN OF TRANSCARPATHIAN REGION

e-mail: klitinskaoksana@i.ua

Prevention of dental caries of permanent teeth in children is one of the topical problems of the contemporary pediatric dentistry, caused by the high prevalence and intensity of this disease. Oral examination of children of different ages in the regions of Ukraine shows a significant increase of the incidence of dental caries of both deciduous and permanent teeth in recent years. Three stages of the reaction in the pulp and dentin can be distinguished in lowering of the protective function of enamel caused by insufficient mineralization of deciduous teeth: infiltration by immunocompetent cells of a subodontoblastic Weil's layer, local cytotoxic destruction of the layer of odontoblasts and diapedesis of lymphocytic elements into the dentinal tubules. The latter phenomenon leads to their blockage and subsequent disturbance of circulation of dental liquor in the centrifugal direction that in turn will cause disturbance of trophism not only in dentin, but also in enamel.

Key words: baby teeth, hard tissues, children.

О.В. Клітинська, В.В. Шетеля, Г.А. Єрошенко, Т.І. Зорівчак, В.І. Струк, Т.Л. Котик, О.Г. Попадинець

СТРУКТУРНІ ОСОБЛИВОСТІ МОЛОЧНИХ ЗУБІВ ДІТЕЙ ЗАКАРПАТСЬКОГО РЕГІОНУ

Профілактика карієсу постійних зубів у дітей – це одна з актуальних проблем сучасної стоматології дитячого віку, яка обумовлена високим рівнем поширеності та інтенсивності цього захворювання. Обстеження дітей різного віку по регіонах України свідчить про значне збільшення за останні роки карієсу як тимчасових, так і постійних зубів. При зниженні захисної функції емалі при недостатній мінералізації молочних зубів у реакції в пульпі і дентині можна виділити три стадії: інфільтрація імунокомпетентними клітинами субодонтобластичного шару Вейля, локальне цитотоксичне руйнування шару одонтобластів та проникнення лімфоцитарних елементів в дентинні канальці. Останнє явище призводить до їх закупорці і пов'язаного з цим порушення циркуляції зубного ліквору в відцентровому напрямку, що в свою чергу зумовить порушення трофіки не тільки в дентині, а й в емалі.

Ключові слова: молочні зуби, тверді тканини, діти.

The work is initiative.

Given that Uzhhorod, Mukachevo, Berehovo and Vynohradiv districts are biochemical in terms of fluoride and iodine deficiency, a significant percentage of the prevalence and intensity of dental caries is registered in this area [9].

Awareness on the morphological structure and physiological properties of enamel of immature teeth allows formulating the task of exogenous prevention of dental caries, namely, to ensure the physiological process of maturation of hard dental tissues and stimulate it, if necessary, to increase the level of enamel caries resistance [3, 6].

The generally accepted mechanism of the onset of dental caries is the progressive demineralization of the hard dental tissues under the action of organic acids, the formation of which is associated with the activity of microorganisms. Many etiological factors are involved in the onset of the carious process, which allows considering dental caries as a polyetiological disease [4, 5].

It is known that at a young age the intensity of dental caries is higher than in the elderly. This is due to insufficient mineralization of tooth enamel immediately after eruption. Maturation of enamel lasts more than two years, and only full mineralization causes greater resistance of tooth enamel to the action of acids, and vice versa, insufficient mineralization creates the conditions for rapid demineralization and dental caries [4, 8].

Prevention of dental caries of permanent teeth in children is one of the topical problems of the contemporary pediatric dentistry, caused by the high prevalence and intensity of this disease. Oral examination of children of different ages in the regions of Ukraine shows a significant increase of the incidence of dental caries of both deciduous and permanent teeth in recent years [1].

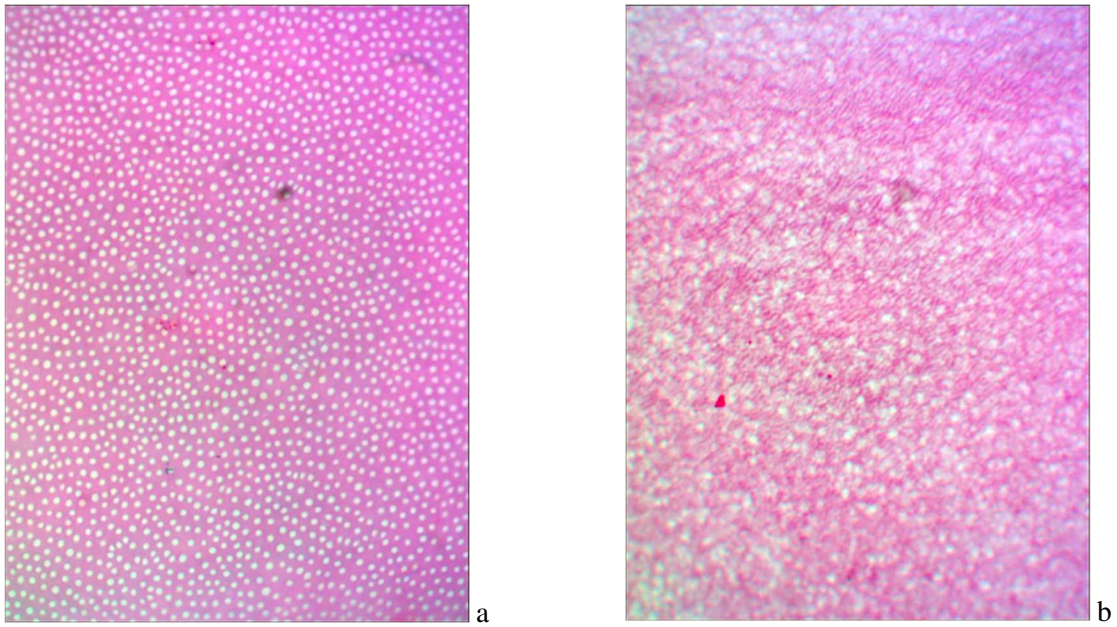
The purpose of the study was the determination of morphological features of deciduous teeth of children of Transcarpathian region.

Material and Methods. The study was performed on 30 teeth extracted for orthodontic indications or during a period of physiological change. The extracted teeth were placed in 10 % buffered formalin for

24 hours, and then subjected to acid-free decalcification. One month later, the implant was carefully unscrewed, the material was embedded in paraffin according to the conventional technique [2] and slices of 5 μm thick were made, which were stained with hematoxylin and eosin.

The study and photodocumentation of the slices was performed using Biorex-3 BM-500T microscope with DCM 900 digital microphoto attachment and software, adapted to the studies, under ×400 magnification.

Results of the study and their discussion. Impaired enamel calcification is directly reflected in the structural organization of dentin due to its alteration. The analysis of the slices stained with hematoxylin and eosin revealed that the structure of the mantle dentin was normal. The dentinal tubules were ordered and had clear boundaries (fig. 1a). Dystrophic changes were detected in the middle layers of dentin. The optical density of peritubular dentin was reduced. The boundaries of the dentinal tubules were not clear, their diameters were polymorphic. The established phenomenon showed disturbance of the processes of calcification of dentin (fig. 1b).

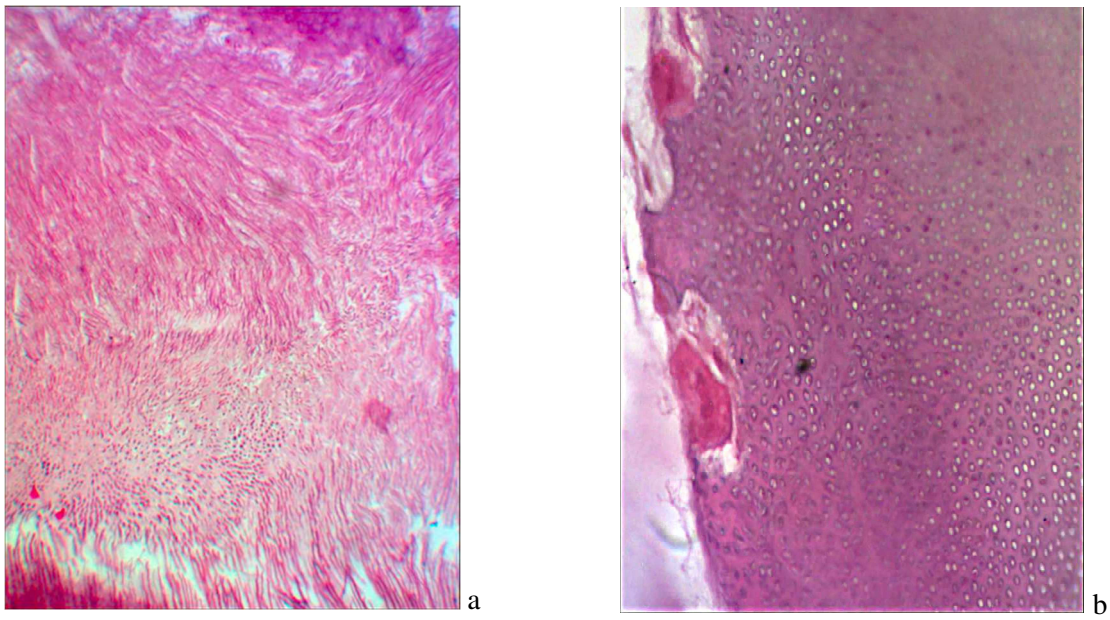


a b

Fig. 1. Structural organization of the superficial (a) and intermediate (b) layers of deciduous tooth dentin. Microimage. H&E stain. Objective lens: × 40 magnification; Ocular lens: × 10 magnification.

At low magnification of the light microscope, the dentinal tubules had an uneven course and formed divergent beams (fig. 2a).

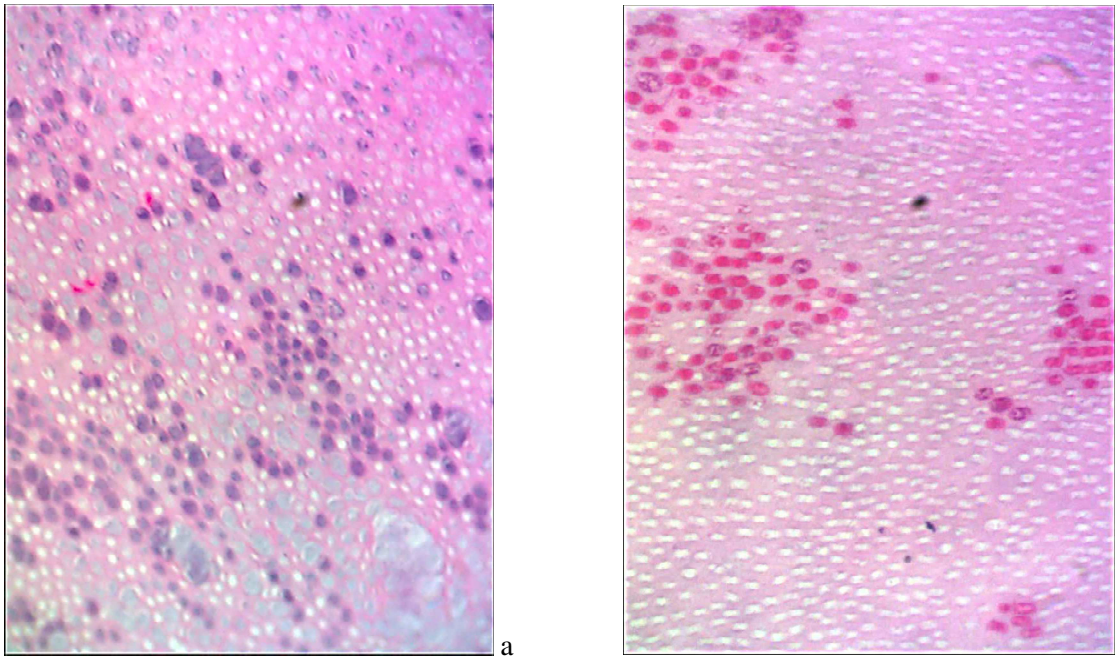
Dentinoclasts were found at the dentin-pulp border, which destroyed the dentin substance (fig. 2 b).



a b

Fig. 2. Disorientation of dentinal tubules (a) and destruction of peripulpal dentin of deciduous tooth by dentinoclasts (b). Microimage. H&E stain. a) Objective lens: × 10 magnification; Ocular lens: × 10 magnification; b) Objective lens: × 40 magnification; Ocular lens: × 10 magnification.

In peripulpal dentin, small-celled elements stained basophilically (fig. 3a) and sometimes oxyphilically (fig. 3b) were detected locally in dentinal tubules that differed in diameter and content.

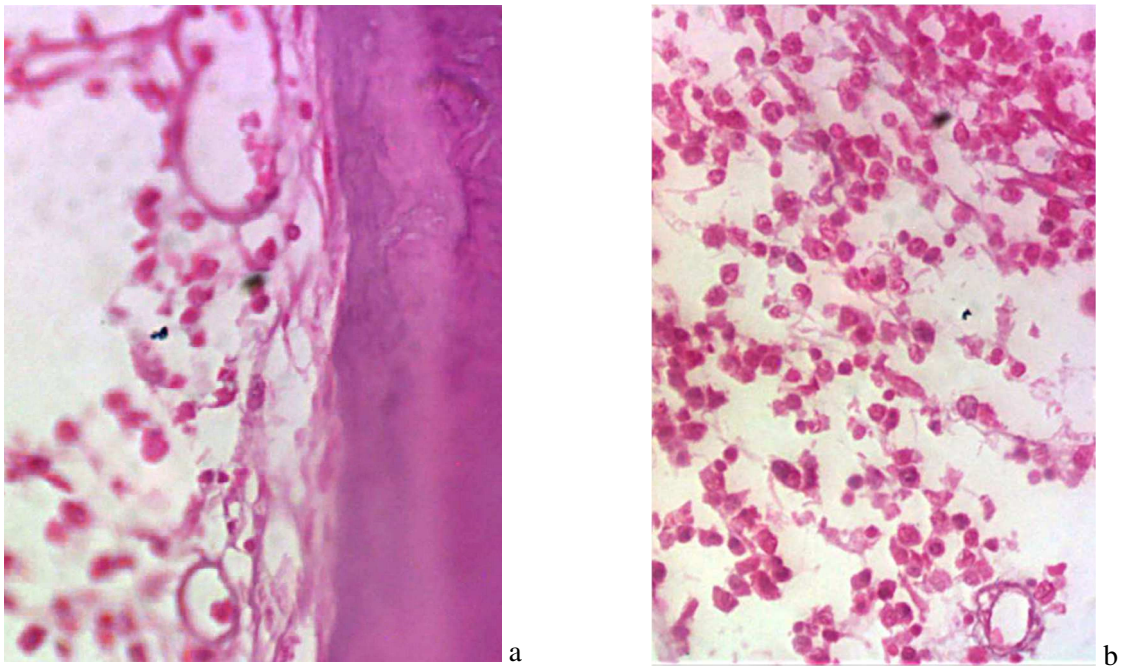


a b

Fig. 3. Basophilic (a) and acidophilic (b) cellular elements in the dentinal tubules of the deciduous tooth. Microimage. H&E stain. Objective lens: × 40 magnification; Ocular lens: × 10 magnification.

In the projection of the detected areas in the peripheral pulp, the number of leukocytic cells increased, the venules were dilated, and the marginal presentation of leukocytes was observed (fig. 4a).

In the central pulp, lymphocytes, macrophages, and plasma cells formed clusters (fig. 4b).



a b

Fig. 4. Dentin-pulp zone (a) and leukocytes in the intermediate layer of the pulp of the deciduous tooth. Microimage. H&E stain. Objective lens: × 40 magnification; Ocular lens: × 10 magnification.

In all cases of observation, in the subodontoblastic layer that corresponded to the detected areas of small-celled infiltration of the dentinal tubules, hematoxylin and eosin-stained slices showed focal small-celled infiltration, which is a source of diffuse cell migration into the Weil's layer. At the same time, in the center of infiltration, partial or complete death of odontoblasts occurs that leads to exposure of predentin and to free opening of ways for migration of immunocompetent cells into dentinal tubules. This is evidenced by the fact that those of them, which are in the area of the former odontoblasts, acquire varying degrees of elongated shape in the direction of the lumens of the dentinal tubules. Microimages

show that the process of diapedesis is reflected in the presence of various transitional forms of lymphocytic cells, from freely orbicular in the subodontoblastic layer to spindle-shaped, which are located in the dentinal tubules of peripulpal dentin, becoming proportionally to the diameter of the latter to 5 μm. The initial size of immunocompetent cells, freely dispersed in the matrix of connective tissue, averages no more than 20 μm.

Thus, the response of the immune system occurs to the disorders of enamel mineralization in the subodontoblastic layer, which involves both lymphocytes and plasma cells with simultaneous death of odontoblasts that indicates the presence of T-lymphocytes among them. Undoubtedly, this immune response is primarily induced by antigenic activation of dendritic macrophages after they present the antigen to T-lymphocytes in the nearest lymph node. All this complies well with the literature [3, 6], according to which two stages of the immune response that develops in the pulp of the tooth in response to carious stimulation, are distinguished: the early phase, during which the number of T-lymphocytes continues to increase and the cellular immune response occurs, and the late phase during which the number of T-helper-inducers increases with a subsequent increase in the number of B-cells and plasma cells, indicating the development of a humoral reaction in the pulp [4, 9]. However, it is very doubtful that the external damage to the enamel was the cause of dystrophic changes in dentin, because the metabolic processes in the hard dental tissues are known to proceed in a centrifugal direction: from the pulp to the enamel, and not vice versa.

Conclusion

Three stages of the reaction in the pulp and dentin can be distinguished in lowering of the protective function of enamel caused by insufficient mineralization of deciduous teeth: infiltration by immunocompetent cells of a subodontoblastic Weil's layer (1), local cytotoxic destruction of the layer of odontoblasts (2) and diapedesis of lymphocytic elements into the dentinal tubules (3). The latter phenomenon leads to their blockage and subsequent disturbance of circulation of dental liquor in the centrifugal direction that in turn will cause disturbance of trophism not only in dentin, but also in enamel.

References

1. Aleksandrov EY. Mikroflora i immunologicheskaya rezistentnost pri kariyese zubov i zabolevaniyakh parodonta na fone sakharnogo diabeta. Mediko-sotsialnye problemy semyi. 2014; 1 (19):109-14. [in Russian]
2. Bagriy MM, Dibrova VA, Popadinec OG, Grishchuk MI. Metodyky histologichnykh doslidzhen monografiya; Bagrij MM, Dibrova VA redaktory. Vinnitsya: Nova knyha, 2016: 328 s. [in Ukrainian]
3. Hyliazeva VV. Rol tsytokinov v razvitii kariyesa zubov. Bulletin "Biomedicine & sociology", 2018; 3 (3):8-11. [in Russian]
4. Hyliazeva VV. Sovremennye aspekty donozologicheskoy diagnostiki kariyesa zubov. Sovremennye problemy nauki i obrazovanyia. 2012; 5: 5-9. [in Russian]
5. Davidov BN. Osobennosti immunnogo statusa u shkolnikov s kariyesom zubov. Klinicheskaya stomatologiya.2012; 4:60-2. [in Russian]
6. Ostapko OI. Vzayemozvyazok khimichnoho skladu emali ta stanu tverdykh tkanyn postiynykh zubiv u ditey, yaki postiyno meshkayut v umovakh nyzkoho rivnia sumarnoho zabrudnennia dovkillia. Klinichna stomatolohiya. 2015; 1: 45-51. [in Ukrainian]
7. Popovych IIu, Petrushanko TO, Yeroshenko GA. Osoblyvosti parodontu svyney v normi ta pry heneralizovanomu parodontyti za umov vidnovlennia vkliuchenykh defektiv zubnykh riadiv riznymy sposobamy. Svit medytsyny ta biolohiyi. 2020;1 (71):206-11. [in Ukrainian]
8. Kheihetian AV, Brahyn EA, Maksiukov SIu, Labushkyna AV, Alutyna EL, Kharseeva HH. Immunologicheskie pokazateli u bolnykh s kariyesom kontaktnykh poverkhnostey bokovykh zubov. Klinicheskaya laboratornaya diagnostika. 2015; 8:52-4. [in Russian]
9. Khomenko LO. Porivnialna kharakterystyka khimichnoho skladu poverkhnevoho sharu emali postiynykh zubiv na riznykh etapakh mineralizatsii. Halytskyi likarskyi visnyk. 2016; 1(23):96-8. [in Ukrainian]

Стаття надійшла 15.06.2020 р.