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The Problem of Caries-Resistant Enamel Formation

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Relevance. Among many anatomical systems, teeth provide abundant information related to the growth and development of the entire body. They change in two sequences, first as milk teeth and then as permanent teeth, so that these changes span the time period from birth to the end of adolescence. The possibility of understanding these changes either during a clinical examination or during certain X-ray procedures makes it possible to assess a person's biological age by analyzing their teeth. Compared with other body systems in children, in particular with the bone system, which can also be assessed using radiography, the development of teeth is considered more reliable. Most dental development studies have assessed dental age using specific radiographic techniques based on the total number of teeth selected. These methods analyze the degree of achieved mineralization of teeth or the size of the exposed tips on radiographs, mostly panoramic. The most common method of assessing DA in children was proposed by [2.4.6.8.10.12].

The application of the sealing method to regulate the processes of enamel maturation of temporary molars in children is evaluated. For this purpose, in 2016-2018, 468 intact first and second temporary molars were examined, which were at the stage of eruption in 61 children aged 11 months to 4 years, who applied to the Department of pediatric dentistry at the polyclinic of the Children's Clinical Hospital and Dentistry at the Moscow State Medical University named after A.I. Evdokimov. The study of the initial level of enamel mineralization in the area of the molar fissures (central fossa) was carried out immediately after the eruption of their chewing surface using the electrometric method. By the end of the study, in the comparison group, against the background of a lower level of enamel mineralization in the area of the central pits of the erupted temporary molars, a higher degree of fissure caries was detected, which amounted to 57.6% of cases. In young children, after 12 months, the complete preservation of the sealant on the temporary molars was 70.26%. The use of glass ionomer sealant in erupted temporary molars reduces the risk of caries of fissures by 95.26%. Despite the loss of the glass ionomer sealant within a year after its application on temporary molars, the fissure enamel maturation in these teeth is accelerated by 33.5%. The damage of permanent teeth by caries begins from the moment of their eruption in children aged 5-6 years. Mineralization of the hard tissues of permanent teeth continues for a long time. The author studied the effectiveness of the combined use of calcium-containing drugs and the ozonation method in the treatment of caries in permanent teeth in children with incomplete processes of mineralization of hard dental tissues. For this purpose, a clinical and laboratory examination and treatment of 41 children aged 6 to 14 years with dentine caries in permanent teeth with incomplete processes of mineralization of hard tissues was carried out. In two study groups, after mechanical and drug treatment of carious cavities, dentin density was measured by fluorescence analysis using a DIAGNO dent device. After determining the degree of mineralization of clinically intact dentin in the first group, Dycal paste and an airtight temporary seal made of glass ionomer cement were applied to the bottom of the carious cavity. In the second group, after mechanical and drug treatment, the carious cavity was ozonated for 30 seconds using a Kavo-HealOzone device, followed by Dycal paste applied to the bottom of the carious cavity and temporary sealing with glass ionomer cement. After three months, temporary filling material and Dycal paste were removed from all teeth in children in both groups and the degree of mineralization of clinically intact dentin was re-measured. This is confirmed by the fact that in dental practice, a doctor often has to deal with children who come to an appointment individually at a time when a certain period of time has passed after teething. In order for the researcher to have the opportunity at any given moment to understand whether the enamel of a particular tooth is fully formed.; to determine the most “dangerous” periods of time for a particular tooth, when parents and people around the child should make every effort to eliminate caries-causing factors, it was necessary to develop new approaches to the problem of a more

specific study of the process of “maturation” of hard dental tissues. In the area of the fissures of the upper and lower premolars, the process of “maturation” of the enamel ends after 5 years; in the cervical region — a year after teething. It occurs differently in the equatorial zone of the lingual surface of the premolars: in the first case, the stabilization of the studied parameters to 0 occurs after a year, and in the second case — after 6 months from the moment of teething. On the upper molars, the fastest “maturation” of hard tissues occurred in the cervical region — after 1 year; then this process ended after 4 years on the lingual surface of the distolingual sulcus; after 5 years - in the anterior fossa, the dystolingual sulcus (on the chewing surface); and finally, after 6 years— in the central fossa, vestibular sulcus, and central sulcus. On the lower molars, the enamel became completely mineralized in the cervical region after 2 years; in the anterior fossa after 6 years, and in the area of all other fissures after 5 years after teething. The research results given by Zhorova T.N. are closer to the data of the authors, who claim that the mineralization of fissures, according to the results of their research, ends 4-5 years after teething. Environmental risk factors and a significant index of caries in young children. The influence of environmental and pathogenic factors on the mineralization of dental hard tissues at an early age was studied in 525 infants aged 3 to 4 years. The dental caries index was determined based on indicators provided by WHO (World Health Organization): prevalence, intensity (dmf), and caries significance Index (SIC). As a result of the research, it was found that the average incidence of dental caries among the study group living in areas with environmentally favorable conditions is relatively lower than among those living in areas with unfavorable conditions, amounting to 39.6% and 63.6%, respectively. A comparative analysis of the average and significant indicators of dental caries showed that the difference is minimal among children living in favorable conditions (1:1.7), compared with children living in ecologically polluted regions, where the significant indicator exceeds the average by about three times. Based on the results obtained, the authors concluded that the dynamics of caries is most pronounced in young children living in regions where the indicator of atmospheric air pollution (with chemically aggressive substances) is several times higher than the maximum permissible coefficient [1.3.5.7.9.11.13].

Enamel remineralization has been studied for about 100 years, and it has been suggested that "noninvasive treatment of early caries by remineralization may be a major achievement in the clinical treatment of this disease Under physiological conditions. Oral fluid (saliva, biofilm fluid) contains calcium (Ca) and phosphate (Pi) in supersaturated concentrations relative to the mineral composition of the enamel." as a result, these ions are permanently deposited on the surface of the enamel. or they are re-deposited in areas of enamel where they have been lost. This can be considered as a natural defense phenomenon, which is promoted by saliva to preserve the mineral structure of the enamel in the mouth. Thus, remineralization is best defined as the re-deposition of minerals lost by enamel, and the term is used as a synonym for the restoration or re-hardening of enamel. Mineral loss (demineralization) or acquisition (remineralization) by enamel is a dynamic physico-chemical process that occurs when oral bacteria form a biofilm on the surface of the enamel, and this biofilm is exposed to fermentable dietary carbohydrates, the most cariogenic of which is sucrose. The caries-causing biofilm is converted into acids as a result of bacterial metabolism, the biofilm fluid becomes undersaturated with respect to the enamel mineral, and demineralization occurs. The pH, which is critically low for tooth dissolution, is maintained for a certain time, but returns to physiological values when sugar exposure stops. Therefore, by increasing the pH and restoring the conditions of oversaturation with enamel, a certain amount of the lost mineral can be restored. This process is called remineralization. The repeated deposition of minerals lost by the enamel can occur under the action of Ca and Pi found in the biofilm liquid, or under the direct action of Ca and Pi of saliva shortly after removal of the biofilm when brushing teeth. However, the amount of calcium and phosphorus gained is less than the amount lost, and the end result is a slight loss of minerals.

Caries process, F very effectively slows down (delays) the development of carious lesions. However, since it does not directly affect the etiological factors responsible for the disease (biofilm and sugar), it will not escape it, and invariably the disease will leave scars on the teeth, clinically visible or not. However, the relative contribution of F - a decrease in demineralization or an increase in

remineralization - to the final effect on caries is unknown, since it is impossible to isolate these effects, given the dynamics of the process. Indeed, some authors believe that the most important effect of F is to reduce the demineralization of enamel, while others believe that F accelerates the process of remineralization, and this is the main mechanism for combating caries. Remineralization of enamel, its clinical use for the treatment of early caries ("fluoride therapy") is recommended. However, the effect of F on the dynamics of the caries process and its success in the fight against caries should not be confused with its stopping or reversing effect on carious lesions. In addition, it should be emphasized that shallow demineralized areas of enamel are remineralized faster than deep ones. The cessation of caries in the form of white spots and the changes observed on the demineralized surface and the subsurface surface of the enamel were well documented years ago. The change in the appearance of the enamel lesions from whitish to shiny was explained by the wear and polishing of the dull, partially dissolved surface of the active lesions, rather than the repeated deposition of lost minerals. However, the porosity of the deeper parts of the lesions was reduced, which indicates a partial remineralization of the lesion body. Therefore, the presence of a surface layer does not prevent subtle changes at the crystal level inside carious lesions after removal of biofilm accumulated on the enamel surface. Restoring the physiological conditions between the enamel and the oral fluid will lead to the re-deposition of minerals in demineralized areas. However, while subsurface lesions are remineralized in vitro within a few weeks, complete remineralization in vivo takes years.

Thus, the effect of F in enhancing enamel remineralization is well known from several in vitro and in situ studies. Given the best knowledge about dental caries, any "remineralizing therapy" should follow two fundamental principles: Dental biofilm, a necessary factor causing caries, should be controlled by brushing teeth. Fluoride should be used either to stop existing lesions or to slow the progression of new ones. The highest fluorescence values were detected in children aged 8-9 years on the chewing surface of the first permanent molars (7.56 and 9.92 rel. units, respectively), while in the mesial pits an average fluorescence value of 5.85 rel. units was recorded, indicating a higher degree of mineralization. In the area of the equator of the teeth, the average fluorescence intensity values were lower than in the neck region. The data obtained indicate the immaturity of the hard tissues of the tooth in the cervical region and in the region of the pits compared to the equator in the first molars. As the age increased, the laser fluorescence indices decreased, which indicates an increase in the degree of their mineralization. In children aged 10-11 years and 12-13 years, fluorescence indices decreased in the area of the central and distal pits of the first permanent molars. The highest fluorescence values were detected in children aged 8-9 years and lower values at the age of 10-11 years on the chewing surface of the first permanent premolars, while no further decrease in the value of the indicator was recorded in children aged 12-13 years. This may be due to the later eruption of premolars in representatives of this age group. In the second premolars, there is a statistically significant ($p<0.05$) decrease in the values of indicators in the area of the central fissure with increasing age. Determining the degree of mineralization of the hard tissues of the tooth after eruption helps the dentist to implement a differentiated approach in providing dental care to the pediatric population.

Conclusion. Dental caries is a violation of the dynamic balance between the processes of remineralization and demineralization in the oral cavity, which closes the metabolic phenomena occurring at all levels and their regulation systems. It is known that the frequency of carious lesions of molars in the first years after their eruption increases due to an increase in fissural caries, therefore, the issue of studying the possibility of regulating the process of enamel maturation of fissures and tubercles of permanent teeth in children using fluoride-containing toothpastes is relevant. The analysis of literary sources shows that an important stage in the formation of a child's dental status is the process of enamel maturation, during which the "peak" of caries incidence occurs. The effectiveness of caries prevention is closely related to the problem of the formation of full-fledged enamel. Prevention of early forms of caries during the eruption of permanent molars stabilizes the foci of caries and reduces its intensity.

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