

## **Improving the Diagnosis and Treatment of Tooth Enamel Demineralization in Children with Heart Defects**

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**Abstract:** Dental caries is a multifactorial infectious disease that can develop at any age - in early childhood, in adolescence and in adults, throughout life, leading to enamel demineralization with the formation of a carious cavity. According to the WHO, caries remains a significant problem in most of the developed world, affecting 60 to 90% of children and the vast majority of adults. The main method of detecting caries is a thorough visual inspection using a dental probe and mirror. Additional methods include vital staining, radiography, electroodontodiagnostics (EOD), etc. In children in permanent teeth, carious defects are often formed against the background of focal demineralization of teeth. The traditional treatment of caries involves the complete removal of enamel with signs of demineralization. This approach to treatment led to a significant loss of hard tissues and weakening of the supporting structures of the teeth.

In a comparative study, the advantages and disadvantages of the studied methods were established and it was found that the most effective is an integrated approach to the clinical situation and a combination of several diagnostic methods, additional use of instrumental diagnostic methods to clarify the diagnosis.

**Relevance of the topic:** The problem of caries and its prevention is a significant problem in all countries of the world, due to the tendency to increase the severity and frequency of the disease.

Numerous studies devoted to the study of the etiology, diagnosis, prevention and treatment of caries in children objectify the relevance of this problem. Dental caries in children is a serious health problem due to the high prevalence of the disease and the low effectiveness of therapeutic and preventive measures.

The traditional process of treating dental caries in children is technically complicated by their negative attitude to the use of a drill and physiological aspects: fatigue, small mouth volume, abundant salivation, etc.

A modern approach to maintaining dental health in children is possible only with early detection and prevention and a minimally sparing approach to the treatment of dental caries.

Diagnosis and prevention of the development of the carious process are still considered important and not fully understood problems in modern dentistry.

It has been proven that caries is a multi-stage process, a combination of risk factors and time is necessary for the formation of a cavity. Dentists cannot always diagnose the onset of a carious process and the risk of caries in the enamel of children's teeth.

Diagnosis of the early stage of caries is one of the most difficult issues in pediatric dentistry. It is difficult to diagnose the early stage of enamel caries with a single visual examination - focal

demineralization of tooth enamel in the form of white or pigmented lesions on the approximate and contact surfaces of hard dental tissues.

It is very important that at an early stage of the formation of a carious cavity, it is possible to stop the progression of the disease process, as well as reverse its development.

The task of dentists today is the maximum preservation of their own tooth tissues, to prevent the pathological process at an early stage of its development.

Diagnosis of caries in an accessible and fast way at the early stages of its development remains one of the urgent problems in modern pediatric dentistry.

Interceptive treatment in temporary and permanent teeth in young children is indicated for a number of reasons. It, first of all, is aimed at the cause of the disease, allows you to save more hard tissues of the tooth compared to preparation, and most importantly, it is almost painless [1,2,3,7].

To reduce the incidence of dental caries in childhood, it is necessary to increase the effectiveness of conservative treatment of enamel caries, since this is the only nosological form of caries that can be effectively treated conservatively and is one of the integral and urgent tasks in pediatric dentistry [2,4,5,8,9].

**Purpose of the study:** Based on the analysis of literary sources, to comparatively study modern diagnostic methods and evaluate the effectiveness of conservative treatment of early caries (ODE) without cavity formation in children.

#### **Materials and methods.**

We examined 115 children aged 2 to 11 years. The intensity of the carious process was assessed according to the WHO index - KPU. Oral hygiene was assessed using an index developed by E.M. Kuzmina (2000) [2]. The criterion for inclusion in the study was the presence of initial caries, focal enamel demineralization (ODE) in the oral cavity in children.

All methods of diagnosing caries can be divided into basic and additional. The main methods for diagnosing caries include: a survey (an anamnesis of the disease, an anamnesis of life), a visual examination: palpation, probing, percussion. There are also additional methods, such as vital staining, selective separation of teeth, radiography, electro-odontometry diagnostics, ultrasound, etc.

The following diagnostic methods can be used to detect and evaluate carious lesions [1,2,4]. Careful visual inspection; vital staining of teeth using macromolecular dyes; digital radiography; computed tomography (TAST); laser fluorescence method using the diagnostic device DIAGNOdent (KaVo, Germany); quantitative light fluorescence method (QIF method); method of electrometric diagnosis of caries (ODE); ultrasound detection of caries.

Visual inspection today is the main clinical method for diagnosing dental caries [1,3] and the main clinical method providing the necessary information for choosing the appropriate treatment [5,8,9]. During visual examination, a dental mirror is used, the use of both a sharp and scary probe is recommended [4,13]. The use of a sharp probe is mainly necessary in order to check the integrity of the enamel. If it is not broken, then the probe slides freely over the surface of the tooth, without lingering in the recesses and folds of the enamel. If there is a carious cavity in the tooth (invisible to the eye), a sharp probe lingers in it. In addition, probing helps to determine the presence of softened dentin, the depth of the carious cavity, communication with the tooth cavity [3,8]. If all the recommended rules of visual examination are observed, it will take 5-10 minutes to examine the patient, depending on the intensity of caries [2,4,6]. But with a visual inspection, the disadvantage is the lack of information content of this method.

Due to the rapid development of dentistry in general, it would be a mistake to rely only on examination when making a diagnosis, so it is combined with other diagnostic methods such as vital staining, radiography, etc.

**Results and discussion:** The method of vital staining of hard tissues of teeth with a dye is one of the most accessible and economical methods for diagnosing early forms of caries. With this method, it is possible to accurately assess the degree of enamel demineralization using 10 or 12 full color diagnostic scale, which allows you to reflect the degree of staining in percent or relative numbers. The stronger the staining of the tooth tissues, the more severe the degree of mineralization.

The method of vital staining is used for the differential diagnosis of caries and non-cariou lesions. This method is based on the penetration of the dye into demineralized enamel at the initial stage of the pathological process, when enamel permeability increases due to an increase in the number of pores, thereby the dye is absorbed, and the lesion is painted in the color of the dye. This method is very convenient, visual and economical, but also has its drawbacks, the inability to assess the depth of the lesion, the difficulty in diagnosing caries in hard-to-reach surfaces.

Imaging remains one of the main ways to diagnose caries to this day, but more and more experts recognize that basic methods are not enough to detect early carious lesions, especially in hard-to-reach places.

The next method used in the clinical practice of dentists is electroodontodiagnostics (EOD), based on determining the threshold of pulp sensitivity to electric current. The essence of EOD is to irritate the tooth pulp with an electric current and determine the minimum current strength until the first weak pain sensations appear. Thus, it is possible to differentiate the forms of caries, to identify its complications. The disadvantages of this method include: the impossibility of detecting initial caries, determining the depth, topography and degree of activity of the carious process, the complexity of working with the apparatus and interpreting the results. Currently, electroodontodiagnostics is considered an inhumane method for detecting caries in children due to the pain reaction.

The method of laser fluorescence using the diagnostic device DIAGNOdent (KaVo, Germany) - allows you to identify changes in the structure of tooth tissues during demineralization, mainly on the occlusal surfaces of the teeth. The laser photodiode of the device emits light waves with a length of 655 nm (red radiation) and a threshold power of 1 mV to the tooth surface. The main advantages of this method are ease of use, the absence of harmful ionizing radiation, the detection of hidden carious cavities, and the recognition of fissure caries. Also, with the help of digital and sound identification, it is clearly possible to determine the severity of the disease. However, the device is not intended for diagnosing the contact surfaces of teeth, since in most cases it is not possible to insert the tip of the device into the interdental space. This significantly reduces the scope of this apparatus [20,21,22].

Another option for diagnosing caries is the Quantitative Light-induced Fluorescence (QLF) method. The apparatus for quantitative light-induced fluorescence is based on a decrease in the ability of dental hard tissues to fluoresce during demineralization. The device is a portable system for intraoral examination with a non-coherent light source and a filter system to replace the laser source. The light emitting system generates blue light with an intensity of 370 nm, which is transmitted through a liquid-filled optical fiber. During the examination, the tooth absorbs a blue impulse stream, thereby healthy teeth glow green, and those affected by caries glow red. The device is designed for early detection of carious lesions due to the loss of fluorescence in demineralization zones, determination of the localization, depth and size of the carious cavity, as well as the severity of the pathological process.

Method of laser fluorescent diagnostics (DIAGNOdent). This device from KaVo (Germany, 1998) diagnoses caries mainly on occlusal surfaces. This instrument contains a laser diode (wavelength 655 nm 1 m W-Court power), an active light unit and a photodiode combined with a long focus filter. In order to detect caries, light is passed through a connected fiber optic fiber to the tip of a cone with a fiber optic outlet. Organic and inorganic molecules of dental hard

tissues absorb light, and fluorescence occurs in the infrared range of the spectrum. The device is intended mainly for the diagnosis of occlusal caries [1,14,19].

The most effective and commonly used method for diagnosing dental caries is interproximal radiography. This method is used to detect "hidden" carious lesions, as well as to determine their depth. It should be noted that it is impossible to determine whether this carious lesion is cavitary or asexual, and also to assess its activity by radiograph, therefore this method is used in children to a limited extent. Before the start of therapeutic measures, all children underwent oral cavity sanitation and the children were divided into 3 groups by blind randomization. In the first group, 23 children underwent remineralizing therapy for ODE with the drug Emal sealing liquid (Humanhemie, Germany). In the second group - 25 children, were treated with a preparation containing silver diamine fluoride "Argenate one-component" ("Vladmiva", Russia). In the third group - 25 children underwent combined remineralizing therapy with rinsing and subsequent application of teeth with 0.01% chlorhexidine solution for 1 minute before enamel remineralization, sealing liquid.

All methods of treatment of initial caries were carried out according to the methods and with the frequency of procedures indicated by the manufacturers in the instructions for the use of materials. Evaluation of the results of the study was carried out after 3, 6 and 12 months in each age group of children.

Of the antimicrobial agents in dentistry, chlorhexidine solutions in various concentrations are more often used. This antiseptic has a pronounced bacteriostatic and bactericidal property. Chlorhexidine acts on both gram-positive and gram-negative microorganisms, as well as fungi.

The effectiveness of remineralization was assessed in the initial carious lesions on smooth surfaces in comparison with that in groups 1, 2, 3. For this, an analysis was made of the dynamics of the state of initial carious lesions in the form of chalky spots on the smooth surfaces of incisors, canines and molars after 3, 6 months and 1 year after the start of treatment and prevention measures.

In children of the 1st group, when using fluorine varnish, there is a decrease in the reduction of ODE by 0.37, in the 2nd group by 0.46 and in the 3rd group by 0.65. Also, other studied indicators of TER and COSRE-test in all 3 groups after 3 months of observation significantly improve compared to the initial values, which indicates the effectiveness of the remineralizing therapy. After 6 months and 1 year after treatment and prophylactic procedures, the trend towards a decrease in the studied parameters persists and remains highly significantly lower compared to the data before treatment.

In children of group 1, remineralization of initial carious lesions was observed in  $34.9 \pm 4.97\%$ , in children of group 2 - in  $45.7 \pm 5.79\%$ , in group 3 - in  $54.5 \pm 6.17\%$  of teeth. The progression of ODE on smooth surfaces during rinsing and application with a 0.01% solution of chlorhexidine is 1.8 times more effective than the application of diamine silver fluoride and 1.4 times more effective than deep fluoridation with an enamel-sealing liquid.

Thus, the inclusion of rinsing and application of a 0.01% solution of chlorhexidine into the complex of therapeutic and prophylactic remineralizing therapy makes it possible to increase the efficiency of remineralization of initial carious lesions in the form of ODE located on smooth surfaces of the teeth by 27.5%.

Children with an acute course of the carious process, as evidenced by the presence of ADE, along with the elimination of common risk factors for the development of the carious process. The use of therapeutic and prophylactic remineralizing therapy with fluorolac preparations, deep fluoridation of enamel with a sealing liquid leads to remineralization of a significant proportion of initial carious lesions, stabilization and regression of caries in the stain stage, while the effectiveness remains high both after 3 and 6 months, and 1 year after conducting remineralizing

therapy, which allows us to recommend these drugs for widespread use in therapeutic and prophylactic remineralizing therapy of ODE in children.

**Conclusions:** A comparison of the main and additional methods for diagnosing caries showed that there is no ideal method for detecting a carious process with adequate sensitivity and specificity for all tooth surfaces. The most effective is an integrated approach to the clinical situation. A combination of several diagnostic methods is acceptable, the choice of which depends on the assessed tooth surface. All of the above hardware diagnostic methods are in addition to the clinical visual examination and are used to clarify the diagnosis. Thus, the diagnosis of carious disease is a complex process consisting of three main stages. Detection of a carious lesion and its assessment (determination of the stage of development of the activity of the process), as well as the diagnosis itself. Using early methods of diagnosing caries in children, the initial lesions of caries can be stopped and even possible to achieve the elimination of the disease with its reverse development. For diagnosing dental caries in children, there is no ideal caries detection method with adequate sensitivity and specificity for all tooth surfaces. The most effective is a combination of several diagnostic methods. The introduction of new methods of diagnosing caries into clinical practice will prevent further development of the carious process in the early stages, as well as facilitate treatment using non-invasive techniques without preparation, while preserving the natural tissues of the tooth. It should be noted the strengthening of the effect of remineralizing therapy in the complex application of them with an antiseptic 0.01% chlorhexidine in all periods of observation.

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