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## TOOTH DECAY IN CHILDREN.

Etiology. Pathogenesis.

Features of the clinical current.

Teaching and methodological guide

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Caries is the most common tooth pathology, especially in childhood. In addition to changing the shape and size of the tooth, changes in its tissues; There is a tendency to slow the maturation of enamel, to interrupt the timely full maturation of other solid tissues. Knowledge of pathogenetic features and clinical forms of carious process in children allows to acquire the skills of detection, diagnosis and planning of treatment of caries.

This manual contains information for acquiring knowledge and skills of identification and diagnosis of nosological forms of tooth decay in children.

The manual is intended for students studying in the specialty of higher vocational education Dentistry.

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**INTRODUCTION.** Tooth decay is a pathological process that manifests itself after teething and is characterized by demineralization and then destruction of hard tooth tissues, followed by formation of a defect in the form of a cavity.

Caries is one of the most common oral diseases. There is ample evidence that 95-98 % of the population has caries in economically developed countries. The incidence of caries is rising worldwide. According to the World Health Organization (WHO), the incidence of caries is also rising sharply among the population of developing countries, especially in areas of intense urbanization.

Caries is a significant dental problem that is very interesting both in theoretical and practical terms. Progressive damage to the hard tooth tissue, compounded by inflammation of the pulp and apical tissue of the periodont, causes severe pain and often leads to tooth loss. This could be a source of somatic disease. Caries infestation of almost the entire population of the planet determines clinical and social significance.

The complicated cariosis process is the cause of the development of pulpitis, periodontitis, purulent inflammatory diseases of the soft tissues of the maxillofacial region.

The cariosis process can turn the oral cavity into a hotbed of chronic sepsis, which can result in many somatic diseases. These include: diseases of the gastrointestinal tract, cardiovascular system, can affect the joints, kidneys, etc.

Chronic oral infection accounts for more than 50% of the total number of chronic outbreaks. These are most often apical periodontitis, marginal periodontitis, teeth that have not been cut (retinal), follicular cysts, gingivitis, periodontitis, etc.

The relationship between the infection site and the body as a whole is very complex, but its essence is the following: a sluggish inflammatory process in the oral cavity contributes to the emergence of active receptor fields of irritation, which leads to changes in the functional state of the central nervous system (CNS).

Violations in the CNS entail violations of the central regulation of the work of various organs and systems of the body, which can lead to the emergence of

functional, and then organic violations. On the other hand, microbial toxins are constantly formed in the lesion, which act on metabolism, biochemistry of organs and tissues, promote sensitization of the body and the development of autoallergenic processes. Gradually such interaction of micro- and macro-organisms depletes compensatory processes and reserve forces of the organism and pathological condition of the organism or organ deteriorates. By reducing the overall resistance of the body, the condition of the infection site deteriorates too. Spot demineralization is more common in children with acute respiratory diseases, which often relapse.

## **Section 1.**

### **ANATOMICAL, MORPHOLOGICAL AND HISTOLOGICAL FEATURES OF THE STRUCTURE OF TEMPORARY AND PERMANENT TEETH AT DIFFERENT PERIODS OF THEIR FORMATION**

Teeth are formed in close connection with the overall development and growth of the child. During the formation they are influenced by a variety of factors of the external and internal environment, which affect both the rate of growth, the degree of mineralization, and the timing of teething.

*In the development of temporal teeth there are 5 periods:*

- inserts and intra-maxillary development;
- teething;
- formation of the root and periodontal;
- stabilization;
- resorption (resorption) of roots.

Temporary teeth are laid at 6-8 weeks of prenatal development. Calcification of temporary tooth enamel begins at 4-5 months of embryonic development. By the birth of the child, the fissures and most of the crowns of temporary molars, 2/3 crowns of temporary canines, and the neck of incisors remain non-mineralized, which explains the most frequent localization of cariosis process in these areas. The intrajaw mineralization of these areas of the teeth continues after the birth of the child for 1.5-11 months, and the final maturation of the enamel occurs after the appearance of the tooth within 2-2.5 years, especially intensively in the 1st year after teething.

Teething begins at 5-6 months of life and ends at 2-2.5 years. During teething, changes occur in the tissues surrounding the tooth, the root of the tooth is formed, the alveolar bone is reconstructed, the periodont is developed and reconstructed. After the final mineralization of the temporal tooth solid tissues and the formation of the root, a period of relative stability occurs, lasting on average 2.5-3 years.

***Features of the structure of temporary teeth that affect the development of caries:***

- the presence of microfractures and microscopes on the surface of enamel;
- the thickness of enamel and dentin layers is half that of permanent teeth: enamel layer, not exceeding 1 mm (about 0.5-0.7 mm), on the approximate surface the distance from the tooth surface to the pulp is 1.6-2.0 mm;
- the enamel of temporal teeth is mineralized less, the Retzius lines are weaker;
- temporary teeth have flatter aproximal contact and pronounced enamel cushion in the cervix area, making early diagnosis of caries of contact surfaces difficult;
- enamel prisms in the area of the cervix in temporary teeth are oriented horizontally, the layer of pristine enamel is weakly expressed;
- dentin is less mineralized, softer, easier to dissect; Its thickness is approximately half that of permanent teeth;
- the rate of formation of secondary and replacement dentin in temporary teeth is higher;
- peritubular dentin absent or weak, dentin tubules wide, short;
- a significant volume of the tooth cavity, the horns of the pulp are located close to the enamelled compound;
- the mesial-buccal horn pulp of temporary molars tends to be closer to the surface of the tooth crown, which poses a high risk when puncturing tooth hard tissues;
- morphologically and functionally immature pulp at the stage of formation of temporary tooth is almost unable to form a replacement dentin.

Therefore, children are characterized by multiple decay of their temporary teeth, acute current, more frequent damage to proximal and nasal surfaces of temporary teeth, and frequent development of circular caries. The smaller layer of enamel and dentin in temporary teeth facilitates the rapid transition of one form of caries into another. Superficial and deep caries in children are clinically diagnosed rarely. Due to the relatively small thickness of the hard tissue of the teeth protecting pulp, the pulp of temporary teeth is involved in the inflammatory process at a relatively shallow cavity caryosis. Short and wide dentin tubules facilitate the rapid

penetration of microorganisms into the tooth cavity, as well as the outflow of exudate from the tooth cavity and as a consequence of the development of primary chronic pulpitis and periodontitis in children.

***During the development and formation of permanent teeth, there are 4 periods:***

- intrauterine and intra-maxillary formation;
- teething;
- the formation and growth of roots and periodontium;
- stabilizing.

The development of permanent teeth generally occurs as well as temporary, but at different times. Thus, their laying begins in the embryonic period (the first permanent molars, incisors and canines) and continues after the birth of the child (permolars, second and third permanent molars). Intramaxillary mineralization begins at the birth of the child (the first permanent molar) and lasts until the age of 7-8 (the second permanent molar). Post-eruptive mineralization of permanent tooth crowns takes longer than temporary teeth. There are two periods in the formation of permanent teeth after their teething:

the 1st period - non-mineralized enamel;

2nd period - complete mineralization of permanent teeth.

***The period of incomplete mineralization of the enamel of permanent teeth***

The process of enamel mineralization (maturation) of permanent teeth after their teething lasts at least 6-7 years and is especially active - in the first 3-4 years. The peculiarities of the clinical course of tooth decay during the period of incomplete mineralization of enamel are related to the features of the structure of permanent teeth during this period.

- The maturation of the enamel of the boughs takes place more intensively than the enamel of the anterior region, and the full mineralization of the enamel of the permanent molars occurs 5 years after their penetration. In the period of incomplete mineralization of the enamel, caries infect the first permanent molars

already at the time of their penetration and the most intense lesion is observed in the first year of enamel maturation.

- Permanent tooth enamel has micropores and has increased permeability for ions and molecules of organic and inorganic compounds from tooth pulp and oral fluid. The presence of more water, lower mineralization and enamel and dentin thickness of permanent, newly cut teeth, and large inter-precipitate gaps and cracks reduce the strength of solid tissues and resistance to pathogenic factors.

- The shape and color of permanent teeth in children have a number of features: the presence of a festoon edge that has not yet undergone physiological erasing; Retzius lines forming on the surface of the pericemata are more pronounced in childhood (this affects the surface shine of the enamel and visually makes it brighter); In «young» permanent teeth are expressed mamelons. All this causes the localization of caries lesions and intensive development of caries of permanent «immature» teeth, i.e. its acute course, a rapid transition of one form to another without a pronounced tendency to restrict the process.

### ***The period of complete mineralization of enamel of permanent teeth***

After 6-7 years after cutting, the enamel mineralization of permanent teeth ends. During this period, the roots of the permanent teeth are formed. Cariosis process is like in adults

## **Section 2.**

### **INCIDENCE AND INTENSITY OF TOOTH DECAY IN CHILDREN IN TERMS OF AGE**

The incidence and intensity of tooth decay among children is high.

The incidence of caries is determined by the number of persons (in per cent) with caries.

Intensity is determined by the number of caries affected teeth, both treated/untreated and removed.



For this purpose, WHO (1962) suggested using the KPU index for adults (K - carious tooth, P - sealed, U - extracted tooth); for children with a temporary or milk bite - kp (k - carious, p - sealed); for children with mixed dentition - KPU + kp.

In order to facilitate a comparative assessment of the incidence of caries in different contingents of the world, WHO in 1980 proposed to allocate 5 degrees of affection depending on the KPU in children of 12 years old - from a very low of 0.0-1.1 to a very high of 6.6 or more, with a gradation of low 1.2-2.6, moderate of 2.7-4.4, high of 4.5-6.5. (Fig)

| <b>Caries Intensity Index</b> | <b>in children aged 12</b> |
|-------------------------------|----------------------------|
| very low                      | 0 - 1.1                    |
| low                           | 1.2 - 2.6                  |
| moderate                      | 2.7 - 4.4                  |
| high                          | 4.5 - 6.5                  |
| very high                     | 6.6 and above              |

Fig. Caries Intensity Index (KPU index ) in children aged 12.

In May 1981, the WHO Assembly established the first global oral health indicator. Children aged 12 should not have more than 3 permanent teeth with caries, 50% of children aged 5-6 should not have caries at all, and 85% of people should not have any teeth removed by the age of 18.

### **Section 3.**

## **FACTORS AFFECTING THE INCIDENCE OF TOOTH DECAY IN CHILDREN. MODERN IDEAS ABOUT THE ETIOLOGY AND PATHOGENESIS OF CARIES**

Caries is a multi-factor, chronic pathological process in which enamel demineralization produces a defect in the hard tooth tissue. At present, this pathology of hard tooth tissue is not fully understood.

World science has about 400 theories of the development of caries. The most famous of them is Miller's theory (1884), called chemical-parasitic, physico-chemical theory D. A. Entin (1928), trophic theory I. G. Lukomsky (1948), theory A. E. Sharpenak (1949), and the concept of academician A. I. Rybakov (1971).

The theory (A. I. Rybakov) that most fully reflects the age aspect of the development of a predisposition to caries and the most carious process is of some interest to the dentistry of childhood. The author considers tooth decay as a pathological polyetiological process. The concept is based on the age aspects of the development of the tooth and jaw system, the influence on the dental tissue of certain endogenous and exogenous factors during certain periods of formation of jaws and teeth. An important role is played by the relationship of the tooth-jaw system with the internal organs and systems of the body, and the leading value of tooth pulp is emphasized.

At each stage of human development, A. I. Rybakov identifies the main endogenous and exogenous factors, the interaction of which leads to the emergence of a cariogenic process.

The 1st is the prenatal period. Great importance is attached to the hereditary factor, the disruption of the formation of the internal organs and systems of the foetus, the development of which is played a huge role by maternal diseases.

The second age period from 6 months to 6 years. Natural feeding, chronic and infectious diseases play a major role. Among the exogenous factors, the author notes that oral hygiene is not respected, as well as abnormalities and deformities of the bite, injuries, salivation disorders and changes in the pH of the mouth.

The third is the period of childhood and youth from 6 to 20 years. The author identifies endogenous and exogenous factors that can lead to tooth decay.

The 4th is the age period from 20 to 40. The main factors during this period are various types of internal diseases, oral hygiene disorders, and imbalances in oral processes.

The fifth is the age period after 40. In this period, there is an even greater disruption in the internal organs and systems of the body, which inevitably affect the state of the mouth.

However, none of the theories can fully explain all aspects of the emergence and development of the caryotic process.

### **Modern concept of tooth decay etiology.**

The development of dental caries is a multifactorial, dynamic process. Mineralised tooth tissues are not inert, as the minerals they contain are in a state of constant demineralisation/remineralisation flux with the oral environment. Caries results when the net demineralising flux prevails over the net remineralising flux. In the classical model, plaque microorganisms, fermentable carbohydrate substrate, a susceptible tooth surface, and time are involved in the initiation and progression of dental caries.

The modern accepted theory of caries etiology considers the process multifactorial. Today everyone agrees that caries is an infectious process that is initiated by a specific microflora of dental plaque, Fermenting for a sufficient time the food carbohydrate components of the plaque with the formation of acids under conditions of low caries resistance of the host.

Conditions of occurrence and development of tooth decay (Fig):

- caries-susceptibility of the dental surface,
- caries-containing bacteria,
- fermented carbohydrates
- timing.

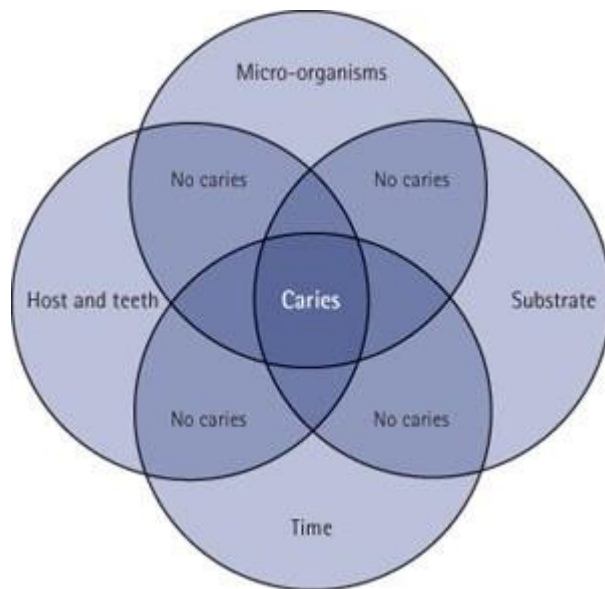


Fig. Conditions of occurrence and development of tooth caries. The Venn diagram emphasises that all four factors must be present and acting together for caries to occur and to progress.

***Dental caries are susceptible to many factors:***

- Property of the tooth anatomical surface: natural fissures and between teeth have favorable conditions for long-term fixation of dental plaque.
- Oral hygiene: timely removal of dental plaque prevents further development of caries.
- Dietary Factor: soft, carbohydrate-rich food contributes to dental plaque. The amount of vitamins and trace elements also affects the general state of the body and especially saliva.
- Quality and quantity of saliva: a small amount of viscous saliva contributes to attachment of bacteria to «pellicle» and formation of dental plaque. The buffering properties of saliva (which neutralize acids) and the amount of immunoglobulins and other protection factors in saliva are very important for the caries resistance of enamel.
- Genetic Factor.
- General body condition.

For children's dentistry is extremely relevant practical value of the concept of «resistance», as its formation is connected with the formation of enamel as a tissue and usually occurs during the laying of temporary and permanent teeth.

The influence of critical factors acting on the body in the intrauterine period of its development also affects the formation of a reduced level of resistance of tooth tissues. If the organogenesis and initial mineralization of the dentition have not been disturbed, resistance will still remain a relatively stable characteristic. It can change in different periods of childhood, when the so-called maturation of enamel occurs, moving to both higher and lower levels under the influence of controlled and relatively manageable factors.

### *Caries*

Many bacteria are found in the oral cavity, but during the formation of dental plaque and subsequent demineralization of enamel, mainly acid-forming streptococci are involved, which are characterized by anaerobic fermentation and lactobacilli.

In recent years, *Streptococcus Mutans* has been considered the most virulent caries-producing microorganism. Other human odontopathogens are *Streptococcus Sobrinus* and lactobacilli.

Studies have confirmed that *Streptococcus mutans* is transmitted orally from mother to child. The decrease in the amount of *Streptococcus mutans* in the mother's oral cavity delays their colonization of the baby's oral cavity. (Kohler, Andreen, Jonsson, 1984).

It has been shown that 52% of children infected with *Streptococcus mutans* by age 3 suffer from tooth decay, while children not infected with *Streptococcus mutans* have caries in only 3% of cases at this age.

Most children acquire caries at ages 1.5 to 3. This period is called «infection window» (Caufield)

The age at which a child is infected with *Streptococcus mutans* is very important and determines the risk of developing caries.

Children whose dental plaque at 2 years already contained *S. mutans*, by the age of 4 were already suffering from active forms of caries, with a value of KPU 10.6, while children whose colonization occurred later, the KPU index was within 3.4. (S.Alaluusua, O.Renkonen, 1982).

According to modern estimates, the average age of infection is 15.7 - 16.0 months; 84% of children have a high rate of oral colonization of *S. mutans*.

However, caries requires not only the presence of microorganisms in the oral cavity, but also the almost constant presence of carbohydrates.

### ***Fermented carbohydrates***

It is the acids formed during the fermentation of carbohydrates that lead to the destruction of the enamel surface. The presence and activity of fermentation in the deposit depends on the quantity and quality of carbohydrates available. The most intense is the fermentation of sucrose, less intense is glucose and fructose. Mannite, sorbit and xylite also penetrate the plaque, but due to the low activity of the enzyme, which turns them into fructose, they are harmless. Starch, which is a polysaccharide, is not caries-related in its pure form, as its molecules do not penetrate the plaque. However, food processing can lead to destruction of the molecular structure of starch and increase its caries.

The higher the carbohydrate consumption, the higher the number of *Lactobacilla*.

If the food content of easily fermented carbohydrates is high, then *S. mutans* will be in symbiotic interaction with increasing amounts of *Lactobacilla*, synthesizing extracellular polysaccharides conducive to increasing the stability of the dental plaque matrix. Many foods loved by children (including some milk mixtures) contain easily fermented carbohydrates. Excess consumption of carbohydrates is one of the most pronounced risk factors for the development of caries.

According to WHO recommendations, the daily diet of children up to 10 kg should contain sugar in a quantity not exceeding 30 g/day.

### ***Timing***

The frequency with which the tooth is caries-affected by acids affects the likelihood of cavities. After each meal that contains sugar, microorganisms begin to produce acids that destroy the enamel. Over time, these acids are neutralized by the buffer properties of saliva and partially demineralized enamel. After each period of exposure to the tooth enamel, the inorganic mineral constituents of the tooth enamel dissolve and can remain dissolved for 2 hours. If carbohydrates are taken periodically during the day, pH will be low for a long time, the buffer properties of the saliva do not have time to restore pH and there is a possibility of irreversible destruction of the enamel surface.

It has now been sufficiently proven that different caries factors have different effects on the development of tooth decay, and the term "caries situation" of the oral cavity has been introduced into dental terminology.

#### **Factors of caries-induced oral situation**

- Dental deposits and food residues
- Lactobacillus Quantity
- The degree of mineralization of enamel in the fissur, outer and approximal regions.
- Degree of tooth resistance to caries
- Food products: non-tural (concentrates) or natural
- Nature of the food: soft or harsh
- Ability of the oral cavity to self-cleaning
- Carbohydrate intake with food
- Content in food and saliva F, Ca, P and vitamins B and D
- Presence of trace elements in food that affect the cariogenic process
- Saliva viscosity: increased or decreased
- Buffer tank of saliva
- Salivation value
- Position of teeth in dental arch
- Tooth density

- Cariosis Process Activity
- Presence of Transmitted or Associated Diseases

The enamel is now seen as a balanced (balanced) bio-physical and chemical structure characterized by demineralization and remineralization processes. If under the influence of pathological factors such equilibrium is disturbed and, starting to predominate processes of demineralization, the enamel begins to gradually lose the inorganic component of enamel and changes its crystal structure. This opens the way for deeper penetration into the enamel of acids and enzymes produced by microorganisms of the oral cavity, which entails further demineralization, but also destruction of the organic matrix of enamel.

#### **Section 4.**

### **CLINICAL CLASSIFICATION OF TOOTH CARIES IN CHILDHOOD**

#### **Classification of tooth decay in children according to T.F.Vinogradova (1978):**

##### 1. By level of activity:

- compensated;
- subcompensated;
- decompensated.

It is important to know that in order to determine the karyotic process activity it is necessary to know the average value of the TFR (kp) in the given age group of the climate-geographical region and to compare this value with the STI (kp) index of the child under examination. In addition, the presence and number of carious lesions at the spot stage must be taken into account, especially when determining subcompensated and decompensated forms of caries.

##### 2. By localization:

- fissure;
- approximal;
- prishechny.

##### 3. By the depth of the lesion

- initial;



— superficial;

— average;

— deep.

4. By the time of occurrence:

— primary;

— secondary;

5. According to pathomorphological signs.

— the stage of the stain, (which can be white, light brown, brown, black);

— enamel caries (corresponds to superficial caries);

— medium caries;

— medium deep caries (corresponds to deep caries);

— deep perforated caries (corresponds to pulpitis).

The practical application of this classification is that:

It allows you to diagnose the caries of the individual tooth and to assess the degree of activity of the carious process in the oral cavity as a whole. This is extremely important for the quality treatment of caries in children, since the use of various filling materials is shown depending on the degree of activity of the carious process. Based on the results of the child's survey, i.e. the combined values of the CPU index, the hygienic index, the presence of caries at the spot stage and the degree of its coloration with methylene blue, the doctor plans the number of examinations, Prescription of remineralizing therapy and scheduled rehabilitation of the oral cavity of the child.

It is important to know the frequency of dispensary observation.

| Form of caries by its intensity | Frequency of events       |                          |
|---------------------------------|---------------------------|--------------------------|
|                                 | inspection-rehabilitation | remineralization therapy |
| Compensated                     | 1 time a year             | 2 times a year           |
| Subcompensated                  | 2 times a year            | 4 times a year           |
| Decompensated                   | 3 times a year            | 6 times a year           |

## Section 5

### FEATURES OF THE DIAGNOSIS OF DENTAL CARIES IN CHILDREN

Diagnosis of caries is a complex process, during which all the information obtained from an objective examination of the patient is summed up, as well as during additional examination methods. The leading clinical sign of tooth decay is the focal demineralization of enamel with the formation of a carious cavity. According to the classification, children have primary, superficial, moderate and deep caries. When diagnosing tooth decay in children should be aware of some features characteristic of the dentistry of childhood.

**The first** is that the anamnesis of young children is collected in the presence of parents.

**Second**, if questions are asked to a child, a number of mutually exclusive questions should be asked in order to differentiate the answers, especially if it concerns the pain symptom, its duration and localization. Sometimes children, in fear, consumed with their own feelings, do not adequately answer the question.

**Third**, when conducting probing and percussion movement should be extremely careful not to cause premature pain to the child. Frightened by the first painful manipulation, even without activating the drill, he may refuse treatment altogether. If the manipulation is supposed to be painful, the child should be warned, in this case, the children should not be deceived. If the child loses trust in the doctor treatment may not take place.

**The fourth** - percussion must be necessarily comparative, and it should begin with a knowingly healthy tooth, which also helps to differentiate the painful symptom and causal tooth.

**Fifth** conduct of all manipulations should be accompanied by explanations of the doctor, with the child should be maintained constant contact, dialogue. All this reduces the psychoemotional tension, promotes the correct diagnosis.

## **DIAGNOSIS OF TOOTH DECAY IN CHILDREN.**

### ***Main clinical methods of the study:***

The clinical examination of a child begins with the detection of complaints and the clarification of the development of the disease until the moment of treatment at the clinic. After finding out the history of the disease it is necessary to obtain information about the history of the child. In order to diagnose the risk factors of caries, the course of the antenatal, perinatal and post-natal periods of a child's life, the features of its early development, the nature of feeding, the diseases that have been transmitted and the presence of chronic systemic diseases are ascertained. Clarify the preventive measures carried out, clarify the diet and nature of the food, assess the hygienic knowledge of the patient (and his parents) and the nature of oral care

The main clinical method for the detection of carious lesions is **visual examination** in optimal conditions (good lighting, preliminary cleaning and drying for 1-5 sec. of the examined teeth). To do this, dental deposits are carefully removed from the surface of the teeth and carefully examined with a mirror and a probe. In the presence of the initial form of caries, individual areas look white and dim.

In order to increase the reliability of the examination, the surface of the tooth is additionally dried, then the brown spots become more bright. In practice, this method is called the "drying method". The diagnosis of surface and subsurface brown spots is carried out by drying the surface of the tooth with subsequent wetting with saliva. Surface carious spots when wetting saliva disappear, subsurface remains.

**Probing** is one of the most commonly used diagnostic methods. The probe is recommended to be used for examination only of well-visible defects and cavities, and for prevention of iatrogenic damage to enamel, the post-eruptive mineralization of which is not completed (natural enamel indentations), should be used.

### ***Additional methods of caries diagnosis:***

**The technique of vital coloring of the tooth surface.** When carrying out vital coloring, the surfaces of the teeth are thoroughly cleaned, the examined surface is

dried and isolated with cotton pads from saliva. A 2% aqueous solution of methylene blue is applied with a cotton swab for 3 minutes, after which the excess paint is removed and the degree of staining (light, medium, high) or on a 10-point scale is recorded (Aksamit L.A., 1979). Areas of healthy enamel are not stained with dye. The method is based on the ability of the dye to penetrate deep and fix itself in the enamel affected by caries, the permeability of which increases during caries.

**Stomatoscopy in ultraviolet light.** This method is based on the optical phenomena of absorption, reflection and double beam of light passing or reflecting from the enamel of the teeth. Due to the demineralization of tooth enamel, the optical characteristic of hydroxyapatite crystals changes. This leads to the fact that due to optical phenomena, carious lesions look darker spots against the background of healthy enamel.

**Electrical conductivity.** The method is based on the ability of carious (demineralized) tooth tissues to conduct current of different sizes depending on their degree of injury, but the method of electroodontodiagnostics may not be widely used in children because,

First, even healthy enamel in different areas of the tooth crown has different resistance, which can distort the true picture of its condition;

Secondly, the degree of mineralization depends on the degree of formation of the tooth root or its resorption, which also distorts the measurement results.

For the diagnosis of hidden cavities, which in children, although rare, but still found, can be useful methods of X-raying and the so-called "**silk thread method**".

The method of diagnosing hidden cavities using silk thread is as follows. The silk thread is injected into the interdental space and pressed against the approximal surface of the tooth, on which the presence of a hidden cavity is assumed. The thread is then removed from the interdental space, continuing to be pressed against the examined tooth surface. If the integrity of the thread is broken and the thread is torn, this indicates the presence of sharp edges of the cavity and diagnoses the latent carious cavity. Similar manipulation, in order to avoid erroneous diagnosis, is carried out in the area of neighboring, knowingly healthy teeth.

**X-ray examination.** The effectiveness of classical X-rays for the diagnosis of caries, especially on occlusal and contact teeth surfaces, is low. In addition to visual examination, a more informative method is interproximal (bitewing). It is important to remember the need to comply with the methodology of this X-ray diagnostics (sample projection, a certain direction of the beam, compliance with the dose and time of exposure to radiation, the method of manifestation of the film) and features of estimation of bite X-ray with different localization, depth and prevalence of carious lesion.

**Laser fluorescence method.** One of the modern methods of caries diagnosis, which makes it possible to increase the sensitivity and specificity of visual examination, is the laser fluorescence method with the aid of the DIAGNOdent device. The pulsed stream of light directed at the tooth surface penetrates into the tooth to a depth of about 1 mm, partially reflecting. The tooth tissues and bacteria affected by the carious process are fluoresced when radiation hits them, i.e. they begin to emit light waves of another length (680 nm). The special optical fiber mounted on the surface of the tooth records the intensity of fluorescence of the hard tooth tissue, which emits radiation invisible to the naked eye. The data are then analysed by the electronic system of the apparatus. The detection of carious lesions is based on the fact that the optical properties of tooth tissues change in the affected areas.

## **Section 6**

### **FEATURES OF CLINICAL TOOTH DECAY IN CHILDREN**

The peculiarities of the course of the carious process in children are due to the structure of hard dental tissues, the lack of stability in the structure of teeth roots and pulp.

It should be noted that the clinical picture of caries in children is not much different from that of adults. Complaints are typically typical of superficial and moderate caries. The size of the cavity (adjusted for enamel and dentin thickness) in temporary teeth is the same as in permanent teeth.

However, in children there are forms of caries characteristic only for temporary

teeth, which require more detailed description.

Circular caries is most common in children

**Circular caries** is a type of carious lesion localized in the cervical region of the tooth and encircling it around the perimeter. The development of this type of caries is due to the later mineralization of the enamel in the neck area, after teething. Weakened, premature, often ill children are more likely to develop circular caries. In the pathogenesis of the development and formation of this pathology plays an important role the timing of teething. It is noted that in children with later teething, circular caries is not commonly found.

The cariosis process quickly spreads to the pulp chamber in case of circular caries, but sharp pulpitis in such teeth are rare. Interestingly, the chronic cariosis process in the cervical region causes abundant formation of a replacement dentin, which, as is known, is normally formed in small quantities. In this case, a complete obturation of the root canal can occur. The result of circular caries is the removal of a temporary tooth in the area of the cervix of the crown. However, the rich formation of a replacement dentin can prevent complete removal of the tooth crown. The pulp in such teeth functions and the root is full.

The second, common form of caries in children is planar caries.

**Planar caries** is a kind of carious process localized, usually in the chewing surface of the lateral teeth and affecting the entire indicated surface. The causes and course of this caries are considered to be similar to the circular caries, but it should not be ruled out that in this case there is an attachment of the etiological factor characteristic of non-carious tooth tissue damage such as hypoplasia.

The feature of the course of caries is the speed of its development, a rapid transition from superficial to medium and deep.

Temporary teeth are not characterized by pigmented spots and pigmented dentin, indicating a rapid demineralization.

With surface and average caries, destructive and reactive changes in enamel and dentin are determined.

The enamel-dentine compound has the least resistance to the carious process.

Therefore, the carious process in this area spreads most rapidly along the enamel-dentine junction and to a somewhat lesser extent into the depth of the dentine. This gives the carious lesion the appearance of a triangle with a vertex to the deep-lying layers of dentin. Some authors explain the development of the carious process along the plane (planar caries) by this factor. The dentin-pulp complex reacts to carious lesions by increasing the mineralization of dentin, which contributes to the blocking of dentine tubules. This reaction is the result of an increase in the function of odontoblasts in response to demineralization processes.

According to the degree of dentin's reaction to the carious process, there are three types:

- reaction to a long, slow-running process with a low level of acid demineralization;
- reaction to a moderately intensive process;
- reaction to an active, rapidly progressing carious process with a high level of acid mineralization.

In the enamel of teeth with superficial caries, the following lesion zones are distinguished:

1. Zone of complete destruction and bacterial invasion.
2. The zone of complete demineralization.
3. The zone of partial demineralization.
4. The area of apparently normal enamel.

In the dentine of teeth with medium and deep caries, such zones of pathomorphological changes can be distinguished:

1. Zone of replacement dentin and changes in the pulp.
2. The deepest layer is the zone of normal dentin. It has normal dentine tubules with odontoblast processes, there are no crystals and bacteria in the tubules.
3. Translucent dentin. This is the zone of demineralization of the interglobular dentin and the beginning of the formation of very thin crystals in the lumen of the tubules. Damage to the processes of odontoblasts is noticeable, but there are no bacteria in the tubules.

4. Transparent dentin. This layer is characterized by a further decrease in mineral substances in the interglobular dentin and the deposition of a significant amount of large crystals in the lumen of the tubules. This dentin is much softer in comparison with intact dentin. There are no bacteria. Collagen fibers retain their structure, which contributes to the processes of self-healing of dentin with normal pulp function.

5. Zone of violations of the histological structure of dentin. It is characterized by the expansion and change in the shape of the dentine tubules, which are filled with a large number of microorganisms. The amount of minerals is minimal, and the collagen fibers are completely destroyed.

6. Infected dentin. This is a zone of destroyed dentin with a large number of bacteria. The structure of dentin is not determined because minerals and collagen fibers are completely absent.

With average caries, certain changes occur in the pulp of the tooth. The layer of odontoblasts is thinning, vacuolized. Electron microscopic examination determines an increase in the number of mitochondria and an underdeveloped endoplasmic network.

In deep caries, especially in the case of its acute course, there is no zone of transparent dentin and an intact dentin zone. The dentin of the bottom of the carious cavity is demineralized with varying degrees of degenerative changes in organic substances. At the same time, significant changes are detected in the pulp, which can be characterized as an initial form of inflammation, namely, pulp hyperemia.

In order to choose the right treatment for caries, it is often necessary to assess the degree of activity of the carious process, which has the following characteristics:

- Carious cavity:

- if it is made with light dentin, then this means a high degree of activity;
- if it is made with dark dentin, then this means a low degree of activity;

- Edges of the cavity

- if the edges of the cavity are brittle, sharp and break easily, then this is a high degree of activity,



- if the edges are rounded and dense, then this is a low degree of activity;
- After dissection
  - if the dentin is soft, light and easily removed, this means a high degree of activity, and is treated in 2 visits,
  - if the dentin is light or pigmented, but dense, then this means a low degree of activity, and is treated in 1 visit.

The carious cavity in children with a high degree of caries activity is characterized by sharp edges, an abundance of soft and light dentin, the walls of the cavity, even after treatment, will remain malleable, poorly dried. Careless treatment of such a cavity is fraught with the danger of opening the pulp chamber. Pigmented fissures in teeth with a high activity of the carious process are very insidious. After their disclosure, an extensive carious cavity is found, the chalk spots are rough, when treated with boron, they easily crumble. Frequent recurrence of caries is possible.

In children with a low degree of caries activity, the carious cavities are pigmented, their edges are smoothed, pathologically altered dentin is dry, dense, pigmented. After the treatment of the cavity, the bottom and walls, although pigmented, are dense, painful when probing. Pigmented fissure is often difficult to open.

Differential diagnosis is carried out with non-carious lesions of the teeth in children, such as hypoplasia and fluorosis, with hereditary disorders of the development of enamel and dentin. Differential diagnosis is carried out based on the collection of anamnesis, the nature of clinical signs characteristic of hypoplasia:

- symmetry of the lesion of certain groups of teeth;
- smoothness and non-stainability of the surface of the defect of hard tooth tissues with organic dyes;
- the characteristic of dental lesions in fluorosis (high fluoride content in drinking water).

## **Section 7**

### **CLINICAL CARIES OF TEMPORARY TEETH WITH UNCOVERED**

## **ROOTS**

Cavities of temporal teeth at the root formation stage are characterized in that the precondition for its formation at the age of 1-3 years are disturbances in the processes of formation of structures of the hard tissues of temporary teeth. This can occur as a result of chronic general morbidity of the mother before and during pregnancy (pregnancy toxicosis). Early tooth lesions and their rapid destruction are common in premature children, as well as in children affected by infectious diseases or rickets in the first months of life.

The peculiarity of the clinical pattern of cavities of temporary teeth at the root formation stage is the sharp and sharp current. Cariose lesions are most commonly localized in the anterior region of the upper incisors and in the fissures of the first and second temporal molars. The cariosis process progresses rapidly and, spreading along the plane, encompasses caries-resistant teeth surfaces (vestibular surfaces of incisors, molars' bulges). Dentin temporary tooth is characterized by rapid lesion due to its weak mineralization and lack of defensive reactions on the part of morphologically and functionally immature pulp.

Early caries is characterized by multiple temporary tooth lesions and symmetrical tooth groups.

Despite the active course of caries, it proceeds almost asymptotically. This greatly complicates the differential diagnosis of various stages of caries by the depth of the lesion, with complicated caries, which is a companion of such multiple lesions. Caries of temporary teeth at the stage of root formation is characterized by a rapid transition to complicated. This is due to the anatomical features of the structure of dentin and pulp. Caries of temporary molars in children 2-3 years old is characterized by an acute course, localized in fissures and spreads beyond the enamel-dentine border. Thus, medium and deep caries prevail. The carious cavity is usually light, the edges of the enamel are thinned, they break easily, the dentin of the carious cavity is light, moist, removed in layers. The carious process is unlimited.

## Section 8.

### CLINICAL CARIES OF TEMPORARY TEETH WITH FORMED ROOTS

**Acute initial caries** - this form is a fast-running carious process and is therefore rarely diagnosed in the clinic. Carious spots are localized in typical locations: fissures, approximal surfaces, alien areas. However, this form of caries is most often diagnosed at the clinic for the first time on the vestibular surface of temporary incisors, as these areas are most accessible inspection. Often these areas are covered with dental plaque, and the subjective sensations are absent, and only after the removal of dental plaque open areas of the enamel is white, lost shine.

**Superficial caries.** This form also tends to fast and sharp current. Enamel creates a defect that is impervious beyond the enamel-dentin boundary. Localization of caries is typical because it is a continuation of the process of initial caries. When examining the cariosis lesion, it is noted rough, with a section of fragile enamel in the center. Complaints are generally absent, but sometimes there is a reaction to chemical stimuli.

Chronic course of surface caries in teeth with formed roots is very rare. It is usually detected during preventive examinations. The cariosis defect has a dark brown color with an enamel defect, the probing is painless.

**Medium caries.** Acute medium caries of temporary teeth is one of the most common clinical forms of caries in teeth with formed roots. Children complain of unpleasant sensations when food enters the interdental spaces, sensitivity to chemical and thermal stimuli. But sometimes there are no complaints at all. During an objective examination, a carious cavity with a narrow inlet is noted. The undercut edges of the enamel have a matte white color. Dentin is light yellow or yellow, soft, easily removed by layers. Probing of the bottom and walls of the carious cavity is painless. Chronic medium caries is localized, as a rule, on the approximal surfaces, less often on the chewing surface or in the cervical region. In this form of caries, the entrance opening of the carious cavity is wide, the walls and bottom are represented by dense pigmented dentin. Probing the bottom and walls is painless.

**Deep caries** in temporary teeth with formed roots also has an acute course. At the same time, children may complain of pain when mechanical or thermal stimuli act. During the examination, it is necessary to pay attention to the condition of the carious cavity, to assess the intensity of caries and the general somatic condition of the child. The carious cavity in acute deep caries is localized within the periculpal dentin. The depth of the carious cavity in temporary teeth is less than in permanent teeth, which is due to the correspondingly smaller thickness of the hard tissues of the tooth. It is also necessary to take into account the localization of the carious cavity, since when it is localized on the approximal surfaces of the teeth, where the layer of hard tissues is thinner, the carious process spreads much faster to the tooth cavity and entails the development of complicated caries. Taking into account the peculiarities of the structure of dentin, the carious process, even with shallow lesions, affects the pulp of the tooth, where functional and then organic changes occur at first. Therefore, when a deep carious cavity is found in temporary teeth, one should be very careful about making a final diagnosis and it is mandatory to conduct a differential diagnostic study with complicated caries.

Chronic deep caries in temporary teeth with formed roots is not common. It is usually diagnosed only in somatically healthy children and with a compensated form of carious process. Chronic deep caries is characterized by a sluggish current, the formation of a dense, sclerotized dentin, formed as a result of activation of protective functions of morphologically mature pulp. An objective examination reveals a cavity with a wide entrance. The dentin is dark brown in color, it is poorly removed by an excavator, when probing, the probe easily slides over the surface of the dentin.

Along with acute and chronic forms of caries in childhood, there are so-called intermediate forms of carious lesions. They carry signs of both acute and chronic caries. At the same time, moderate decalcification and pigmentation of dentin in the carious cavity is observed. Dentin is usually yellow-brown in color, but its consistency is soft and easily removed by an excavator. However, with necrotomy, it is still possible to achieve thorough removal of necrotized dentin and preserve its dense layer between the carious cavity and the tooth cavity.

## **Section 9.**

### **CLINICAL PATTERN OF CAVITIES OF TEMPORARY TEETH DURING ROOT SYSTEM RESORPTION**

The development of carious process in temporary teeth during root resorption is less common. In clinical practice, complicated caries in the form of chronic pulpitis and periodontitis are more often diagnosed. However, in somatic healthy children there is also a classical form of chronic caries. The depth of the lesions most commonly occurs medium and deep caries, very rarely superficial. The most common cavities in temporary teeth with resorptive roots occur in canines.

Acute occurrence of caries in teeth with resorptive roots is very rare and as a rule in children with general medical conditions and reduced immunity. Such forms of caries occur in children with no complaints.

## **Section 10.**

### **FEATURES OF PERMANENT TOOTH CARIES IN CHILDREN AND ADOLESCENTS**

Caries of permanent teeth in children and adolescents also have a number of features related to the clinical flow. These features are primarily related to the stage of formation of the roots of permanent teeth and, to a large extent, the general health of the child.

The frequency of damage to individual teeth of permanent bite in children has a fairly clear pattern. Most often, the first permanent molars of the lower jaw are affected, followed by the second permanent molars of the lower jaw, after which the eponymous teeth of the upper jaw follow according to the frequency of the lesion. In second place in terms of the frequency of lesions are the upper incisors and premolars. The upper canines and lower premolars are most rarely affected. And the most resistant to caries are the lower incisors and canines.

In children, acute forms of caries damage to permanent teeth prevail, which is due to the incompleteness of the mineralization processes and the insufficiently

expressed protective function of the pulp during the completion of the formation of the root system and mineralization.

There is a certain pattern between the timing of teething and their caries infestation. So it is noted that in children with delayed teething, the carious process is much less frequent. At the same time, the shorter the period after the eruption of the tooth and its caries damage, the deeper and sharper the carious process proceeds. During caries in teeth with formed roots, intermediate forms of the carious process are more often observed, bearing signs of both acute and chronic processes. This is due to the gradual intensification of mineralization processes and a more adequate reaction from the more formed tooth pulp. Since the plastic functions of the pulp are already more pronounced at this stage, the formation of replacement dentin is more pronounced. Multiple caries of permanent teeth is more indicative of the immunodeficiency state of the child's body. Therefore, a thorough examination of such children by a pediatrician, consultations of related specialists are necessary.

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