MODERN IDEAS ABOUT THE NATURE OF DENTAL DISEASES

Semenov Kostiantyn Arnoldovych
Candidate of Medical Sciences, associate professor of the Department of Dentistry of the Faculty of Postgraduate Education
Dnipro State Medical University, Ukraine

Stepanova Svitlana Vasylivna
Candidate of Medical Sciences, teaching assistant of the Department of Dentistry of the Faculty of Postgraduate Education
Dnipro State Medical University, Ukraine

Summary. Dental caries depends on medical, geographical and living conditions, age, body state, diet, and the degree of oral hygiene. In some people, the first signs of dental caries can be detected already during the eruption of both milk and permanent teeth. Features of clinical course of the caries process in children are associated with the nature of structure of hard dental tissues and body responsiveness.
Dental caries is determined by many factors, and under appropriate conditions, they can cause the disease.
However, along with the indisputable role of local cariogenic factors, the importance of general factors should also be taken into account, as metabolic disorders during the development, formation and maturation of teeth affect the composition and structure of dental tissues and can weaken their resistance.
Elimination of the causes and conditions for the occurrence and development of diseases, as well as increasing the body’s resistance to adverse environmental factors is the main task of prevention.

Keywords. Caries, causes of a cariogenic situation, prevention

Dental caries depends on medical, geographical and living conditions, age, body state, diet, and the degree of oral hygiene. In some people, the first signs of dental caries can be detected already during the eruption of both milk and permanent teeth. Features of clinical course of the caries process in children are associated with the nature of structure of hard dental tissues and body responsiveness. Dental caries is particularly likely to occur in people with various chronic diseases, in particular, infectious diseases and allergies. Numerous experimental and clinical studies confirm the dependence of development and nature of dental caries on the state of the body’s resistance. According to professor V.K. Leontiev, the state of reduced resistance of dental tissues to cariogenic effects due to the impaired nonspecific body’s resistance due to past and existing somatic diseases is a cariogenic situation.
Cariogenic situation is created when any cariogenic factor or a group of them affects the tooth, making it sensitive to acids.
Cariogenic situation in the oral cavity is affected by such factors as physical and chemical properties of saliva, and in particular, the viscosity, which depends on the amount of salivation, and the buffering capacity of saliva. Viscosity of saliva depends not only on the activity of salivary glands, but also on the state of physiological processes in the body as a whole. Main factor determining the viscosity of saliva is the amount of organic components in its composition, primarily proteins and mucopolysaccharides. The same fact also affects the buffering capacity of saliva, that is, its ability to neutralize acids formed in the oral cavity during biochemical processes of digestion, which is ensured by presence of bicarbonates.

Dental caries is determined by many factors, and under appropriate conditions, they can cause the disease.

Caries process progresses if the rate of salivation decreases, the amount of saliva decreases, and its viscosity increases, and, on the contrary, the caries process slows down or stops at the spot stage if there is a sufficient amount of saliva and its of normal viscosity. High concentration of macro- and microelements in saliva also stops caries, while a low concentration of microelements and a high content of mucin causes its progression. Changes in the biochemistry of saliva and dental plaque play a very important role in the development of dental caries. However, along with the indisputable role of local cariogenic factors, the importance of general factors should also be taken into account, as metabolic disorders during the development, formation and maturation of teeth affect the composition and structure of dental tissues and can weaken their resistance.

In case of caries pathology in the oral cavity, the following parameters of the oral fluid change: rate of salivation, viscosity, mineralizing potential and remineralizing activity, pH, calcium, and phosphorus content, etc.

It is known that the disease is the result of imbalance in the tooth enamel-saliva system under the influence of various unfavorable factors, one of which is saliva acidification. Acidification leads to a decrease in the degree of supersaturation of the oral fluid with $\text{Ca}^{2+}$ and $\text{HPO}_4^{2-}$ ions and a decrease in its mineralizing potential.

Saliva plays an important role in the formation and maintenance of dental caries resistance. This is confirmed by the results of clinical observations, according to which hyposalivation is associated with more intense dental caries, and xerostomia in 100% of cases results in rapid destruction of all teeth.

Qualitative changes in saliva are perhaps the only way, in which, along with neuro-reflex changes, the changes in the body affect the state of the oral cavity. Changes in salivation can occur due to influence of local and general factors.

It is known that composition and properties of saliva correlate with functioning of the autonomic nervous system. It is believed that parasympathetic innervation plays an important role in the regulation of salivary glands functioning, as each cell is heavily entwined with branches of parasympathetic fibers, irritation of which leads to the formation of acetylcholine in the synapse, which triggers the activity of glandular cells.

Studies showed that the intensity and prevalence of dental caries has been proven to be higher in practically healthy children with sympathectomy. In children with sympathectomy, the synthesis of proteins, which are involved in mineralization and protection of enamel from cariogenic factors, by salivary glands decreases, and
the reason for this is insufficient stimulation of secretory function of the glands in sympathotonia. Severity of dental caries in practically healthy children has a certain difference and depends on the state of the autonomic nervous system: intensity of dental caries in children with sympathectomy is 3 times higher than in children with a balanced state of the autonomic nervous system (normotony). Increase in the tone of sympathetic division of the autonomic nervous system reduces the mineralizing properties of the oral fluid and impairs the synthesis of proteins, which are involved in mineralization and protection of enamel, by salivary glands. Resistance of teeth to dental caries directly depends on the concentration of proline-rich proteins in saliva. Most of the biologically active factors in saliva are peptides or glycoproteins. It is proved that many of them are secreted from salivary glands, both into the oral fluid and into the blood (nerve and epidermal growth factors, parotin, kallikrein, tonin, etc.). Impaired production of these factors by salivary glands occurs in a number of diseases, and in some cases is the basis of their pathogenesis.

More and more literature data indicate that psychoemotional states affect the content of certain biochemical components in saliva. Thus, concentration of cortisol in children's saliva correlates with their behavioral reactions, and the level of testosterone in children's saliva correlates with their learning ability. There is a certain correlation between psychoemotional stress and cortisol levels, as well as between some depressive states and testosterone levels. There are reports of fluctuations in the concentration of secretory IgA against the background of negative emotions.

Generally recognized mechanism of dental caries is the demineralization of hard dental tissues, which progresses under the influence of organic acids, formation of which is associated with activity of microorganisms. Experiment showed that the rapid development of dental caries in animals with desalination is due to the rapid emergence of highly acidogenic flora – Str. mutans.

Leading factor in the occurrence and development of dental caries is dental deposits and the related influence of microbial waste products on enamel. Main cariogenic microorganisms of dental plaque are streptococci and lactobacilli, which produce a number of organic acids, of which lactic acid is the most cariogenic. Dental plaque reduces the resistance of teeth to dental caries because it is a source of microorganisms, center of fermentation of carbohydrates and formation of organic acids.

A number of experimental studies show that dental caries occurs when the state of nonspecific body's resistance changes.

A.V. Hranin et al., Cisowski, Everhartetal indicate the low content of lysozyme in saliva in children with multiple dental caries, compared to the group of children with intact teeth.

Decrease in sIgA level precedes the intense dental caries. In patients with acute and "flowering" dental caries, a decrease in the amount of total protein, a decrease in the absolute amount of albumin, α-globulins, and an increase in the concentration of neuraminic acid were found by Yu.S. Husev.

In caries-resistant individuals, a high content of sIgA was found (D.W. Legler et al.). It is also found that with insufficient production of sIgA, synthesis of IgM increases as compensation. In the absence of IgA and IgM in saliva or a significant decrease in both, there is a tendency to increase the intensity of dental caries.
Another important component of the oral fluid that characterizes the course of pathological processes in the oral cavity is peptide complexes with an average molecular weight of 500 to 5000 daltons. Medium molecules are products of protein degradation and unidentified toxic substances of medium molecular weight. Biochemical composition of medium molecules is not fully determined, but it is known that the main source of their formation is increased proteolysis. Concentration of "medium molecules" reflects the level of pathological protein metabolism. Proteins are the main functionally important secretory components of salivary glands, and mixed saliva integrates the products of activity of all salivary glands and thus contains the maximum information on the state of the body. One of the tests for endogenous intoxication is the determination of the content of medium molecular weight polypeptide compounds – "medium molecules". Endogenous intoxication is a syndrome characterized by accumulation of excess products of normal and distorted metabolism in the tissues and biological fluids of the body. Causes and factors that cause endogenous intoxication syndrome are very diverse and complex in nature. However, most often the syndrome develops in pathological conditions associated with tissue destruction, metabolic disorders, starting the humoral mechanism of intoxication and activation of various biologically active substances that support and enhance the impaired metabolic reactions, and a decrease in the functional activity of natural detoxification systems.

Prevention is a system of state, social, hygienic and medical measures aimed at ensuring a high level of health and preventing diseases.

Purpose of prevention: eliminating the causes and conditions for the occurrence and development of diseases, as well as increasing the body’s resistance to adverse environmental factors.

Basic requirements for prevention: knowledge of etiology and pathogenesis of the disease is a prerequisite for prevention.

Types of prevention:
- **Primary** prevention is a set of measures aimed at preventing the development of diseases in healthy organs and tissues.
- **Secondary** prevention is a set of measures aimed at preventing the development of diseases at early symptoms of their occurrence.
- **Tertiary** prevention is a set of measures aimed at treating and preventing complications associated with the developed disease.

Directions for prevention:
- Influencing the macroorganism for general health improvement.
- Reducing the effect of pathogenic factors in the oral cavity.
- Strengthening the resistance of the oral cavity to pathogenic influences.

The following is necessary for the general recovery of the macroorganism:
- Strict daily routine
- Balanced nutrition
- Moderate physical activity
- Rational change of activity
- Outdoor activities

Risk factors for diseases of the parts and tissues of the oral cavity:
- Microorganisms and plaque;
Deficiency of micronutrients in food and drinking water;
Excess sugar in food;
Genetic predisposition;
Congenital defects and deformities;
Psychogenic stresses;
Chronic diseases of organs and systems;
Autoimmune processes;

Methods for implementing preventive measures:
Verbal (explaining the need for preventive measures);
Endogenous method for implementing preventive measures;
Exogenous method for implementing preventive measures.

Endogenous and exogenous prevention methods are divided into:

- Endogenous drug-free method
- Endogenous drug method
- Exogenous drug-free method
- Exogenous drug method

Endogenous drug-free prevention includes: eating food rich in proteins, vitamins, micro- and macronutrients.
Endogenous drug prevention includes: taking vitamins, calcium and fluoride, food concentrates, and extracts, which are taken in courses, depending on age.
Exogenous drug-free prevention includes: intensive chewing of hard foods, good personal oral hygiene with the use of therapeutic and prophylaxis dental pastes, professional hygiene, and rational orthodontic and orthopedic treatment.
Exogenous drug prevention includes: local administration of remineralizing agents.

Periods of child development and preventive measures

- Antenatal
- Newborn and nursing (up to one year)
- Infant (1-3 years)
- Preschool (4-7 years)
- School age (18 years)

Preventive measures during different periods of development:
Antenatal and nursing (up to one year) – mother’s nutrition, natural feeding, frenectomy.
Infant – daily routine, rational nutrition, culture of consumption of carbohydrate food, oral hygiene.
Preschool – oral hygiene, oral cavity sanitation, prevention of bad habits.
School – individual and professional oral hygiene, daily routine, balanced nutrition, oral cavity sanitation, prevention of periodontal diseases.

Prevention methods:
- Community
- Group
- Individual

Individual prevention methods:
- Hygiene items (toothbrushes, floss, toothpicks, irrigators, brushes)
- Hygiene products (tooth powders, toothpastes, gels, mouthwashes)
- Standard method of brushing teeth.
Treatment and preventive measures:
- Oral cavity sanitation
- Professional oral hygiene
- Teeth coating with fluoride varnishes
- Sealing
- Physiotherapy

Dental prevention programs:
- Planning
- Financing
- Human resourcing
- Epidemiological survey
- Program implementation
- Program monitoring
- Evaluation of the program's results at various stages, correction and further implementation.

References: