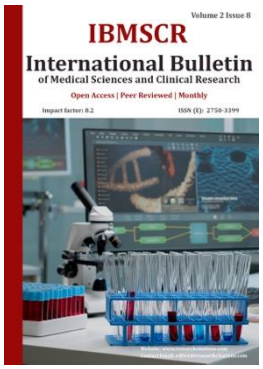

A NEW APPROACH TO THE PREVENTION OF DENTAL CARIES

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Abstract. The knowledge that caries is a dynamic and reversible process has led to the development of new technologies capable of detecting caries at the earliest stages (before the appearance of a cavity) for timely treatment and prevention. 70 years of experience in the use of fluorides for the prevention of caries has shown their reliability and ability to participate in the remineralization of hard dental tissues, but their effectiveness decreases in the acidic environment of dental plaque (with poor oral hygiene). Daily oral hygiene using a paste containing 1.5% arginine, 1450 ppm fluoride and calcium bicarbonate helps to stop the development of dental caries and reduces the risk of new cavities even in conditions of poor oral hygiene.

Key words: dental caries, microbial biofilm, fluorides, arginine, remineralization, neutralizer.

Аннотация. Знание того, что кариес — это динамичный и обратимый процесс, привело к разработке новых технологий, позволяющих выявлять кариес на самых ранних стадиях (до появления полости) для своевременного лечения и профилактики. 70-летний опыт применения фторидов для профилактики кариеса показал их надежность и способность участвовать в реминерализации твердых тканей зубов, однако их эффективность снижается в кислой среде зубного налета (при плохой гигиене полости рта). Ежедневная гигиена полости рта с использованием пасты, содержащей 1,5% аргинина, 1450 ppm фторида и бикарбоната кальция, помогает остановить развитие кариеса зубов и снижает риск возникновения новых полостей даже в условиях плохой гигиены полости рта.

Ключевые слова: кариес зубов, микробная биопленка, фториды, аргинин, реминерализация, нейтрализатор

Izoh. Kariyesning dinamik va qaytariladigan jarayon ekanligi haqidagi bilimlar kariyesni o'z vaqtida davolash va oldini olish uchun uni eng erta bosqichlarda (bo'shliq paydo bo'lgunga qadar) aniqlashga qodir bo'lgan yangi texnologiyalarni ishlab chiqishga olib keldi. Kariyesning oldini olish uchun ftoridlardan foydalanishning 70 yillik tajribasi ularning ishonchliligi va qattiq tish to'qimalarining remineralizatsiyasida ishtirok etish qobiliyatini ko'rsatdi, ammo ularning samaradorligi tish plastinkasining kislotali muhitida (og'iz bo'shlig'ining yomon gigienasi bilan) kamayadi. 1,5% arginin, 1450 ppm ftorid va kaltsiy bikarbonat bo'lgan pastadan foydalangan holda kunlik og'iz gigienasi tish kariesining rivojlanishini to'xtatishga yordam beradi va og'iz bo'shlig'i gigienasi yomon bo'lgan sharoitlarda ham yangi bo'shliqlar xavfini kamaytiradi.

Kalit so'zlar: tish kariesi, mikrobial biofilm, ftoridlar, arginin, remineralizatsiya, neytralizator.

Introduction. Dental caries is a multifactorial infectious disease that can develop at any age of the patient (in early childhood, adolescence and adulthood) throughout life, leading to demineralization of enamel with the formation of a carious cavity. According to the World Health Organization (WHO), dental caries remains a significant problem in most developed countries of the world, affecting 60-90% of schoolchildren and a significant proportion of adults. Dental caries is most common in Asian and Latin American countries, where the incidence in children and adults approaches 100% [4]. In Uzbekistan, the average intensity of dental caries is 2.5 (CPI index), and the prevalence is more than 80% [3].

The main risk factors for the development of caries are: the role of cariogenic microorganisms in the oral cavity (Streptococcus Mutans, Lactobacilli, etc.), a diet with a predominance of easily digestible carbohydrates, changes in the properties and composition of saliva. socioeconomic level of the family, dental visits, etc. In addition to cariogenic factors that have a constant and permanent effect on the hard tissues of the teeth, leading to demineralization of enamel, there are protective mechanisms (composition and properties of saliva, fluorides) that can shift the balance towards the remineralization process. Thus, if the integrity of the hard tissues of the teeth is preserved, the carious process can be stopped a Clinical studies prove that the level of oral hygiene plays a significant role in the development of dental caries. Dental plaque is a complex biofilm that forms over time on the enamel surface, especially in areas that are difficult to reach with a toothbrush (contact surfaces of teeth, cervical area), as well as on the mucous membrane of the soft tissues of the oral cavity (back of the tongue, mucous membrane of the cheeks, alveolar processes). It has been proven that up to 1000 types of microorganisms are colonized in the thickness of dental plaque, depending on its maturity and localization [10]. The species composition of microorganisms in dental biofilm depends on its location (hard tissues of teeth or mucous membrane), the presence of natural pits and fissures on the enamel (in which “old” dental plaque is consolidated), the level of oral hygiene, etc. The bacterial composition of dental biofilm can be relatively stable and contain predominantly non-pathogenic microorganisms, but the microbial balance can be disrupted due to significant changes in the environment (for example, a shift in pH to the acidic side due to the consumption of food with a high content of easily digestible carbohydrates or a low level of oral hygiene). Such changes lead to the growth of cariogenic microorganisms and the replacement of “healthy” biofilm with pathogenic one [15, 16].nd even reversed [23].

Thus, a decrease in the pH value below the "critical" leads to the leaching of calcium and phosphates from the enamel crystal lattice and the development of demineralization of hard dental tissues [14]. The process of caries development consists of a shift in the balance between cariogenic and protective factors: if cariogenic factors prevail in the oral cavity, then the demineralization process dominates, if protective factors prevail, then remineralization is launched and the development of caries stops. Alternation of de- and remineralization cycles can occur for a long time until reaching the "end point" - the formation of a carious cavity. The fact that the development of dental caries is a dynamic process and reversible at the initial stages is of particular importance in the treatment and prevention of caries, and early diagnosis of lesions allows for timely prevention and treatment of focal demineralization [7].

Much attention is currently paid to the topic of detecting caries at the earliest stages of development. To replace traditional visual diagnostic methods (drying, vital staining), researchers around the world are increasingly using modern international criteria for

assessing the degree of carious damage (ICDAS II). More accurate hardware methods for detecting caries are also used, such as: DiagnoDent, based on the laser radiation method; DiagniCam, based on the digital transillumination fiber optic glow method; QLF, based on the light radiation method, etc. The use of modern methods improves the process of caries diagnostics and allows not only to detect damage long before the formation of a cavity, but also to visually assess the degree of its severity [2, 8, 9, 24].

The fact that dental caries is a dynamic and reversible process is the basis for caries prevention. Fluorides have been used for caries prevention for over 70 years. Numerous clinical studies have proven that fluorides stabilize demineralization and accelerate the process of remineralization of hard dental tissues. The WHO Expert Committee confirms the importance of regular oral hygiene with the use of fluoride-containing preparations to maintain oral health at the population level. The use of endogenous and exogenous methods of dental caries prevention significantly reduces the growth of caries. According to WHO, fluoridation of drinking water reduces the prevalence of dental caries by 15.0%, the use of fluoride-containing toothpastes and mouth rinses reduces the growth of caries by 24-26%. Fluoridiones promote the incorporation and retention of calcium and phosphate ions in the enamel structure, forming a fluorapatite compound, which is more resistant to acids than tooth enamel. At the same time, there is no reliable data that the use of fluorides is harmful to the body [13, 25].

The recommended concentration of fluorides in drinking water, salt, toothpastes depends on age, the degree of risk of developing caries, the concentration of fluoride in water in a given region, which is important for reducing the likelihood of developing fluorosis.

The most accessible and widespread method of fluoride prophylaxis at the mass level remains regular daily oral hygiene. Despite the fact that the vast majority of toothpastes for adult patients presented on the market contain fluoride, the intensity and prevalence of caries still remains high.

European and American dental associations, the Russian Dental Association (StAR), and WHO consider it ethical to brush children's teeth with fluoride-containing toothpastes, with the exception of people living in areas with high fluoride content in water [26]. Numerous studies and systematic reviews from the Cochrane database aimed at identifying the most effective and safe concentration of fluoride in toothpastes for the prevention of dental caries in adults prove the high effectiveness of twice-daily oral hygiene with fluoride-containing oral hygiene products with a fluoride concentration of at least 1000 ppm, compared to fluoride-free toothpastes. Toothpastes with a higher fluoride concentration (1500-5000 ppm) are recommended for patients with a high risk of developing caries. Low-fluoride (500 ppm) oral hygiene products are prescribed to children under 6 years of age to prevent and balance the risk of dental caries and the risk of fluorosis. Numerous studies have shown that dental caries correlates with poor oral hygiene and poor-quality tooth brushing. Given this fact, there is a need to create technologies that can not only influence the processes of demineralization and remineralization in hard dental tissues, but also suppress the pathogenicity of plaque on the enamel surface [3].

A new technology, Sugar Acid Neutralizer™ (SAN), meets these requirements [20]. An important component of the new generation toothpaste based on this technology is 1.5% arginine, which is a natural amino acid that is normally present in saliva [5, 18, 19, 22].

The new technology is based on the principle of changing the pH of dental plaque by using the arginine deaminase enzyme pathway in argininolytic (non-pathogenic) bacteria (e.g. S. Sanguis). It is argininolytic bacteria that break down arginine into an ammonium base, which is capable of neutralizing plaque acids and stabilizing the microbial balance of the dental biofilm [4]. Thus, increasing the pH of dental plaque creates a favorable environment for stopping demineralization and starting remineralization, maintaining ecological balance in the microbial biofilm and providing it with a "healthy microflora" [17]. Clinical studies using the QLF early stage caries diagnostic device have shown that the use of toothpaste with 1.5% arginine, 1450 ppm fluoride and insoluble calcium compound (study group) is more effective in stabilizing demineralization and stimulating remineralization of hard dental tissues compared to pastes containing only 1450 ppm fluoride (control group). Analysis of the volume of initial carious lesions (ΔQ) after 6 months of using arginine-containing toothpaste was 44.6% less than at the initial examination, while in the control group ΔQ was 28.9% less than at the initial examination, respectively.The difference in the parameters between the new oral hygiene product and the positive control was statistically significant

A study of root caries in adults showed that after only six months of using a toothpaste with arginine, 1450 ppm fluoride and an insoluble calcium compound (study group), root caries stabilized in 93.0% of cases, and only 0.7% showed progression of lesions, while the use of a toothpaste containing only 1450 ppm fluoride (positive control group) led to stabilization of root caries in 91.0% of cases, while caries progression was noted in 9.0% of cases, respectively. The data obtained between the groups were statistically significant. Thus, arginine-containing toothpaste stabilizes and remineralizes root caries significantly more effectively compared to a toothpaste containing only 1450 ppm fluoride [11].

Conclusions. Modern understanding of caries development and knowledge that caries is a dynamic and reversible process have led to the development of new technologies capable of detecting caries at the earliest stages (before cavity formation) for its timely treatment and prevention. The use of fluorides is undoubtedly the main method in the prevention and treatment of dental caries, but fluorides are not able to affect plaque acids, therefore, their effectiveness is reduced under poor hygiene conditions. Understanding this fact has led to the need to create a technology capable of supplementing the remineralizing activity of fluorides with the ability to influence the pH of dental plaque. The unique NSC technology has such properties. Clinical studies using this technique prove its effectiveness in preventing and stabilizing the carious process. Thus, daily oral hygiene using a paste based on the new technology will help stop the development of dental caries and reduce the risk of new carious cavities even under conditions of low oral hygiene in patients at the population level.

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