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THE ROLE OF DIET AND LIFESTYLE IN THE DEVELOPMENT OF DENTAL CARIES: A CLINICAL ANALYSIS OF RISK FACTORS AND PREVENTIVE POTENTIAL

Abstract

Dental caries is still a frequent finding in dental practice, even though preventive care is widely available. This article focuses on the role of diet and daily habits in increasing or reducing the risk of caries. The analysis is based on the author's clinical observations and data from evidence-based studies from 2014–2020. It is shown that the key factor is not the total amount of sugar in the diet, but rather how many times a day the teeth come into contact with an acidic environment. Patients who snack more than four times a day have 30–50% more active lesions than those who stick to three main meals. The habit of eating before bed increases the risk of caries by 40–60%, since saliva performs almost no protective function at night. Reduced salivation, associated in particular with the use of certain medications, is found in 15–25% of patients; in this group, active caries occurs in 60–80% of cases. Changing dietary and hygiene habits can prevent up to 70% of new lesions, and the first noticeable results appear within 1–3 months.

Keywords: dental caries, diet, lifestyle, sugar exposure, salivation, stress, oral hygiene, prevention.

Introduction. Dental caries is one of the most common chronic diseases in humans. According to a study on the global burden of disease, untreated caries of permanent teeth affects approximately 2.5 billion people worldwide [1, 3]. Despite

significant progress in understanding the pathogenesis and the emergence of effective preventive measures, the incidence rate is not decreasing in most countries.

In his practice, Stoianov regularly encounters patients with extensive caries who genuinely do not understand why. The person does not eat a lot of sweets, brushes their teeth, and yet still comes in with new lesions. Upon detailed questioning, the picture becomes clear: coffee with sugar in the morning, something sweet before lunch, more coffee after work, and fruit or cookies in the evening. The person does not consider any of these instances to be “a meal,” but each triggers an acid cycle in the mouth. The difference between “what they eat” and “how often they consume it” determines the rate of enamel destruction in most patients with active caries.

Traditionally, the development of caries is explained by the interaction of pathogenic biofilm, a carbohydrate substrate, and a susceptible host [2]. Clinical observations indicate that the decisive factor is not so much the presence of sugar as the pattern and frequency of its intake throughout the day [4, 5]. The activity of the process is also influenced by the quality and regularity of oral hygiene, reduced salivation, levels of chronic stress, and medication use [7, 8].

The purpose of this article is to analyze which dietary and behavioral factors most influence the development of caries and to determine which lifestyle changes yield tangible preventive results.

Literature review. **Prevalence of Dental Caries and Current Understanding of the Disease.** Global epidemiological data indicate that untreated caries of permanent teeth affects between 2.3 and 2.5 billion people [1, 3]. An analysis of trends from 1990 to 2017 showed that the prevalence of the disease has hardly decreased despite increased access to dental care [10]. Frencken et al. emphasize that in groups with lower socioeconomic status, caries progresses more rapidly and is more often left untreated [7].

Pitts et al. describe caries as the result of an imbalance between the destruction and repair of hard dental tissues under the influence of biological, behavioral, and social factors [2]. Machiulskiene et al. proposed a classification that distinguishes between active and inactive lesions and places the activity of the process at the center of clinical assessment [9]. This approach is important for prevention: the goal is not only to treat existing lesions but also to prevent new ones from developing.

Sugar and Caries: Frequency Matters, Not Quantity. A systematic review by Moynihan and Kelly confirmed that if the proportion of free sugars in the diet does not exceed 10% of daily caloric intake, the risk of caries is significantly reduced [4]. In its 2015 guidelines, the World Health Organization recommends reducing this proportion to 5% for maximum effect [6].

At the same time, Moynihan draws attention to an important nuance: it is not only the amount of sugars but the frequency of their intake that determines the caries risk [5]. Each intake of carbohydrates triggers acid production by the biofilm and lowers the pH in the mouth below 5.5, at which point enamel destruction begins [2]. Saliva requires 30 to 60 minutes to neutralize the acid and initiate repair [2, 4]. With two to three meals a day, this time is sufficient. With six to eight meals and snacks, the enamel barely leaves the demineralization zone.

Lifestyle, Stress, and Saliva Composition. Chapple et al. demonstrated that caries is linked to a person’s overall health: stress levels, sleep quality, and dietary habits alter the composition and quantity of saliva, which directly influences the risk of caries [8]. Chronic stress reduces saliva production, disrupts sleep patterns, and leads to irregular eating habits, increasing the risk even without changes in diet.

Saliva protects teeth in several ways: it physically washes away food debris and bacteria, neutralizes acids through the bicarbonate buffer system, and restores enamel through calcium and phosphate ions [2, 8]. When there is insufficient

saliva, all these functions weaken simultaneously: acid remains in contact with the enamel longer, plaque accumulates faster and is removed more slowly, and the enamel does not have time to regenerate between acid attacks.

Hujoel et al., in a systematic review of randomized studies, confirmed that regular oral hygiene reduces the incidence of caries, and interdental cleaning has an independent protective effect, especially in the spaces between teeth where a toothbrush cannot reach [11].

Materials and methods. This study is based on the author's clinical experience gained during dental consultations. Each patient with active caries was interviewed about their dietary habits: how many times a day they eat or drink something sweet, whether they have a habit of eating in the evening or at night, and how often they consume beverages throughout the day.

Oral hygiene was assessed based on the results of the examination, not on the patient's word. The color of the plaque indicated exactly where the person was not cleaning their teeth. The condition of the gums during probing indicated the duration and quality of cleaning in specific areas. The edges of restorations and the cervical areas indicated places where plaque accumulates constantly. A comprehensive medical history was taken to determine whether the patient was taking medications that reduce salivation, what their stress level was, and whether they had sleep problems.

For comparative analysis, patients were grouped based on the frequency of sugar intake (up to three times and more than three times per day), the regularity of oral hygiene, the presence of reduced salivation, and whether they followed preventive recommendations. Results were verified during follow-up examinations at 1–3 and 3–6 months. The numerical indicators presented correspond to data from systematic reviews and epidemiological studies [1, 3, 7, 10, 11].

Research results. **Prevalence of Dental Caries.** According to Stoianov's observations, dental caries is found in 70–80% of patients who come in for an

appointment. Multiple lesions are present in 30–40% of them. In children, both rates are higher: caries is present in 80–90%, and multiple lesions in 40–60%. Among adults, caries is found in 60–70%, and multiple lesions in 20–30% of patients.

Diet and the Frequency of Caries. Based on Stoianov's experience, a typical day for patients with active caries looks like this: coffee or tea with sugar in the morning, something sweet between tasks before lunch, coffee again after work, and fruit or cookies in the evening. People do not consider any of these episodes to be "meals." But each one lowers the acidity in the mouth, and if the next intake occurs too soon, enamel remineralization does not take place. Another common feature: the absence of distinct meal times. People snack throughout the day, and this is worse for the teeth than three full meals with breaks in between.

On average, patients had 2–4 sugar exposures per day. However, 40–50% exceeded four exposures per day. In this group, there were 30–50% more active carious lesions than in patients with three meals. At the same time, the total amount of sugar consumed did not differ significantly between the groups. Stoianov notes: the same piece of chocolate, eaten all at once, has almost no effect on the teeth; the same piece, consumed in small portions over several hours, results in a series of acid attacks.

Sweet, carbonated, or acidic beverages were consumed regularly by 40–50% of patients. The number of lesions in this group was 30–50% higher. Drinking slowly in "sips throughout the day" proved particularly harmful: a single glass of beverage that a person sips on for an hour or two results in numerous acid exposures. Carbonated drinks have their own acidity, so even without sugar, they can soften the enamel surface. Citrus juices and other acidic drinks usually damage the enamel in another way: they contribute to erosion. The surface of the tooth becomes less glossy, looks duller, and sensitivity may appear over time.

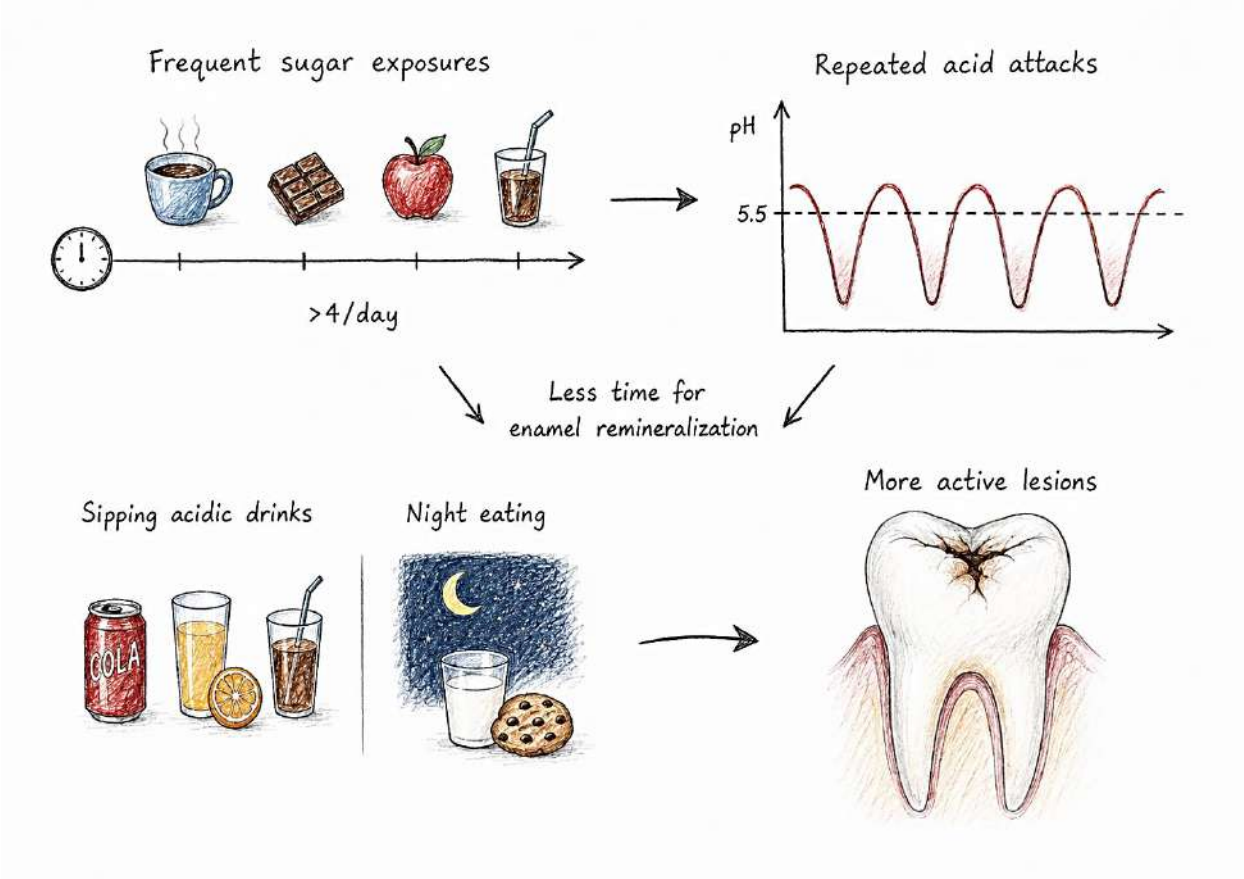


Figure 1. How Frequent Sugar and Acid Exposure Increases the Risk of Active Caries

The habit of eating before bed or at night was found in 20–30% of patients. The rate of caries in this group was 40–60% higher. The reason: at night, saliva production is low and does little to neutralize acids. The acidic environment following an evening snack can persist throughout the night, and during this time, enamel does not regenerate.

Hygiene: the gap between what the patient says and what is seen during the examination. 40–50% of patients brush their teeth twice a day, about 30–40% once a day, and another 15–20% brush irregularly. The less frequently teeth are brushed, the more damage occurs: with once-daily or irregular hygiene, there is on average 30–60% more damage than with twice-daily brushing.

In his practice, Stoianov notes a significant discrepancy between what the patient describes and what is observed during the examination. Most people are

convinced that they brush their teeth well. However, after staining the plaque on the cervical areas, in the interdental spaces, and along the edges of fillings, plaque is usually present. Moreover, these areas recur from examination to examination because the hand moves along the same habitual trajectory. The condition of the gums upon probing and darkening along the edges of fillings indicate how long this has been going on.

Only 30–40% of patients regularly used interdental brushes or dental floss. In this group, caries and gum inflammation were 20–40% less common. Most people avoid interdental cleaning due to discomfort or believe that a toothbrush is sufficient. However, a toothbrush physically cannot reach the spaces between the teeth, and it is precisely there that most plaque accumulates, leading to new lesions.

According to Stoianov's observations, a patient who "doesn't eat anything special" and "brushes their teeth well" but has active tooth decay typically has frequent, hidden exposure to acids (sugary tea between meals, fruit, small snacks) and uncleaned areas in two or three typical spots. It is precisely this combination, without any other causes, that explains the clinical picture.

Reduced salivation, stress, and lifestyle factors. Signs of reduced salivation were observed in 15–25% of patients. Among them, active caries was observed in 60–80% of cases, whereas among patients without this issue, it was observed in 20–30%. Clinically, such patients are more likely to have multiple caries, rapid progression of initial lesions, and lesions in the cervical regions. Reduced salivation was most commonly observed in patients taking antidepressants, antihypertensives, or antihistamines, as well as in the elderly and those who breathe through their mouths.

Patients with chronic stress and disrupted daily routines (30–40% of the total) had 30–50% more carious lesions. Stoianov notes that stress usually shows

up first in everyday habits. A patient may still brush their teeth, but do it quickly, skip the evening routine, drink more coffee, or snack on sweets between meals.

Table 1. The Gap Between Reported Oral Hygiene and Clinical Evidence of Plaque Retention

Hygiene factor	Observed pattern in patients	Clinical finding
Brushing frequency	40-50% brushed twice a day; 30-40% once a day; 15-20% irregularly.	Once-daily or irregular hygiene was associated with 30-60% more damage than twice-daily brushing.
Patient self-assessment	Most patients believed they brushed their teeth well.	Plaque staining often showed remaining plaque in cervical areas, interdental spaces, and along filling margins.
Repeated missed areas	The same areas remained uncleaned from visit to visit.	The brushing movement followed the same habitual trajectory, leaving persistent plaque accumulation.
Gum and restoration margins	Gum condition during probing and darkening near fillings were evaluated.	These signs helped indicate how long plaque retention had been present.
Interdental cleaning	Only 30-40% regularly used floss or interdental brushes.	In this group, caries and gum inflammation were 20-40% less common.
Main hidden risk	Patients often reported a normal diet and good brushing.	Active caries was usually linked to frequent hidden acid exposure and two or three chronically uncleaned areas.

Irregular sleep and chaotic eating make the situation worse: saliva protects the enamel less effectively, while frequent snacks repeatedly lower the pH in the mouth. If the patient also has bruxism, the edges of fillings are exposed to additional pressure and wear.

The Difference Between Children and Adults. For children, the main problem is that neither their diet nor their hygiene is within their control. They do not control what they eat or whether they brush their teeth, and therefore, tooth decay in children largely reflects family habits. In families where parents frequently snack themselves and do not monitor the child’s hygiene, the risk is

higher. Children's enamel is less mineralized, so tooth decay progresses faster than in adults.

Adults are more aware, but the leading risks are acquired chronic habits: a work routine with constant snacking, coffee with sugar as a daily ritual, and dry mouth due to medication. Adults have more fillings, and there is a high-risk zone around each one. A new filling in an unchanged cariogenic environment will need to be replaced in two to three years for the same reasons.

What changes after behavioral correction. According to Stoianov's observations, the fastest results come from two simple changes: completely avoiding food after evening toothbrushing and regular hygiene every night. Within just 1–2 months, new lesions stop appearing. If the patient also reduces the number of snacks during the day, the initial demineralization spots stabilize within 3–6 weeks. Additional results come from switching from "sips of sweet drinks throughout the day" to occasional consumption and starting to use interdental brushes.

Patients who followed the recommendations had new lesions in 10–20% of cases, while those who made no changes had them in 40–60% of cases. The risk of new lesions among those who ignored the recommendations was two to three times higher. According to Stoianov's estimates, 50 to 70% of new cases of caries can be prevented simply by changing diet and hygiene habits without any treatment.

Stoianov's Structured Approach to Behavioral Caries Risk. Building on these observations, Stoianov systematized his clinical approach into a structured preventive model with three elements. First, a behavioral caries risk assessment scores each patient by the frequency of sugar and acid exposures per day, the timing of intake (night-time and post-brushing eating), salivation status, and the verified - not reported - level of plaque control. Second, an algorithm for detecting hidden risk factors directs attention to causes patients rarely report themselves:

"healthy" hidden-sugar foods (yogurts, muesli, bars, juices), medication-induced reduced salivation, and the gap between reported and clinically observed hygiene.

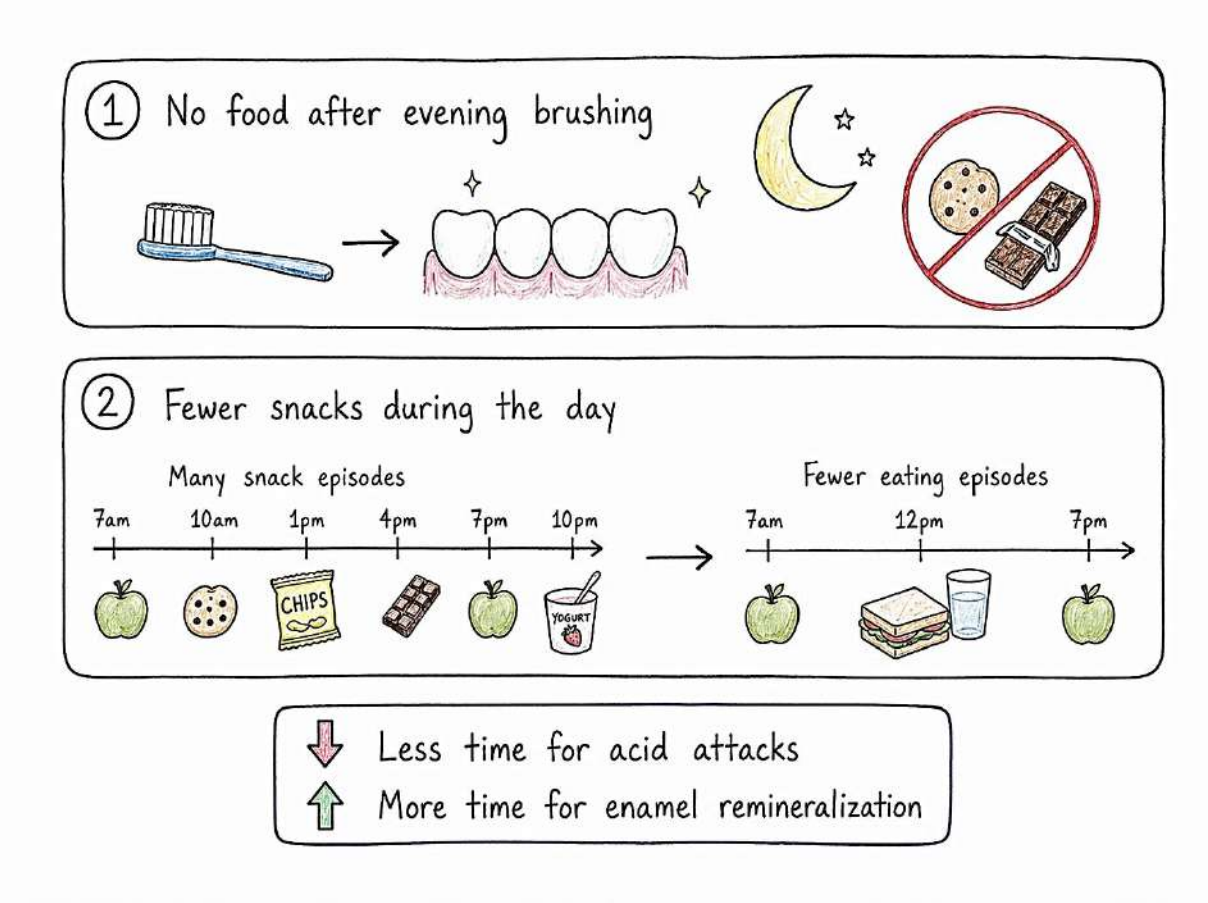


Figure 2. Behavioral Changes That Reduce Acid Exposure After Brushing and Between Meals

Third, a targeted behavioral correction plan replaces generic advice with two priority changes - eliminating night-time and post-brushing intake and reducing exposure frequency - followed by monitoring of new lesions. This three-part structure links risk identification directly to measurable behavioral outcomes.

Clinical observations. A patient with five to seven active lesions consulted Stoianov. When asked about his diet, he replied that he practically never eats sweets. However, during the conversation it turned out that he had tea or coffee with sugar four to six times a day, fruit or cookies in between, and a sweet drink in the evening. He did not clean between his teeth in the evening. After the patient understood the mechanism and changed his routine (three meals a day, nothing in

between, regular evening hygiene), no new lesions appeared over the next 6–12 months, and the initial spots stabilized.

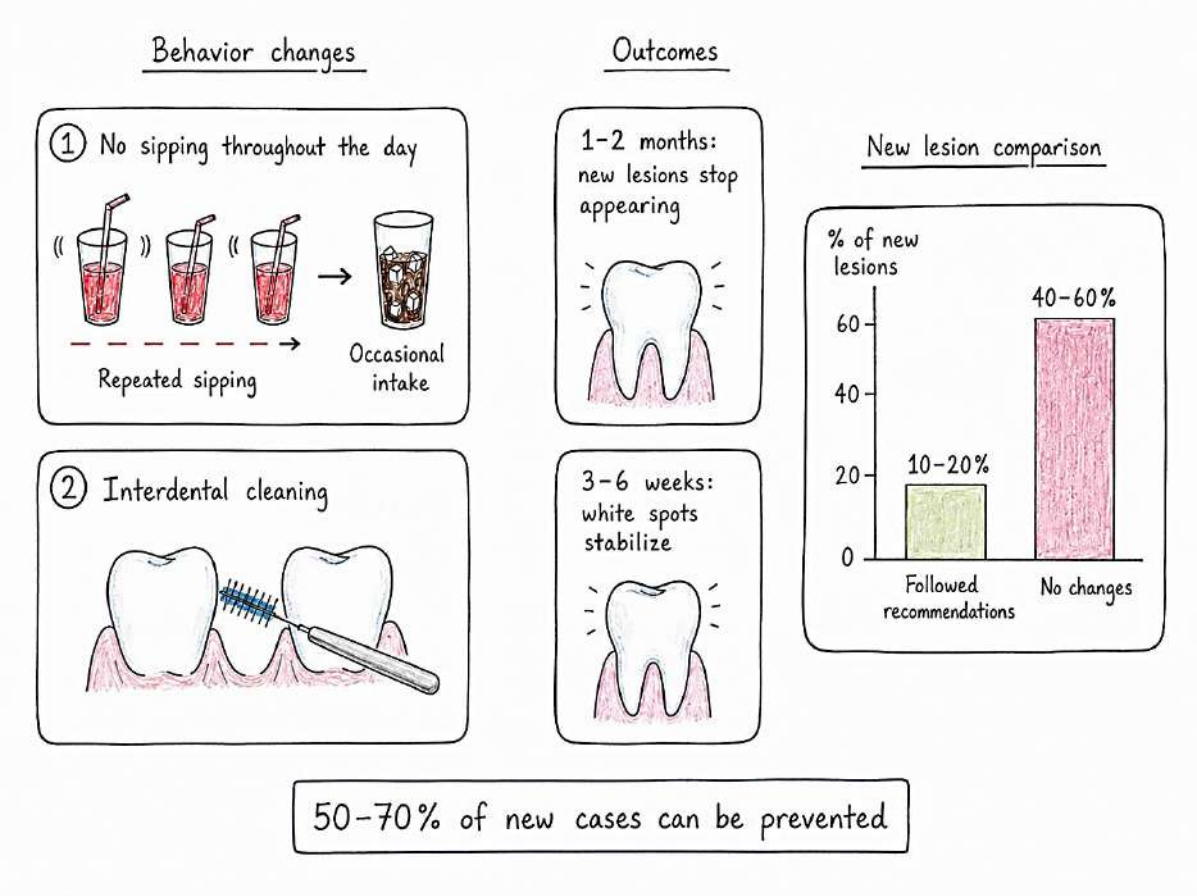


Figure 3. Clinical Outcomes After Behavioral Correction: Stabilization and Fewer New Lesions

Another patient brushed his teeth twice a day and wondered why there were four to six new lesions. The medical history revealed: a sweet drink that he sipped in small sips throughout the entire workday. This resulted in a continuous acid load that no amount of tooth brushing could compensate for. This case from Stoianov's observations clearly demonstrates: good hygiene does not protect if the frequency of acid exposure is too high. After changing just this habit, new lesions stopped appearing.

A patient complaining of dry mouth and four to six lesions, particularly in the cervical regions. The explanation appeared only after Stoianov reviewed the patient's medication history. She was regularly taking a drug for high blood

pressure that could reduce salivation. Until then, the case looked unclear: the patient did not consume much sugar and maintained good hygiene. After adding hydration recommendations and more intensive fluoride prevention, new carious lesions appeared less often.

A child with five to seven lesions. The parents did not understand the cause: they claimed there wasn't much sugar. However, the family had a habit of constant snacking and drinking sugary beverages, and toothbrushing was not monitored. After the parents changed their own habits and began monitoring the child's hygiene, no new lesions appeared over the next 6–12 months.

Stoianov also observed a patient who, despite being given recommendations when he had two or three initial lesions, made no changes and stopped coming for checkups. Within 3–6 months, the number of lesions increased to four or five, and deep cavities appeared. This case demonstrates a simple pattern: early-stage caries does not stabilize on its own without changes in the environment.

Discussion of results. **Why Dietary Habits Are More Important Than Sugar Intake.** Data from clinical observations align with the findings of the evidence-based literature: when daily sugar intake is the same, the incidence of dental caries depends on dietary habits [4, 5]. This comes as a surprise to patients, which is why Stoianov explains it in his practice without using technical terms: a tooth doesn't decay from a single piece of candy. It decays because the same situation repeats itself too often throughout the day - acid is present, but there's no time for recovery. Explaining things through a person's actual daily routine, rather than through theory, increases the chance that they will make a change.

"Healthy" foods require a separate explanation: yogurts, muesli, bars, and fruit juices have a reputation for being safe, but they contain fermentable carbohydrates and have a sticky consistency that lingers on the teeth. Frencken et al. emphasize that a preventive consultation should be part of every appointment, not an optional add-on [7].

Medications and Saliva: The Hidden Cause. The significantly higher incidence of caries among patients with reduced salivation confirms that saliva is one of the main protective factors in the oral cavity. In Stoianov's experience, it is precisely medication-induced reduced salivation that is often the hidden cause of multiple caries in a patient whose diet and hygiene appear entirely normal. Chapple et al. note that general health status and medication use are an integral part of caries risk assessment [8].

Why recommendations aren't followed and how to change that. Less than half of patients follow dietary recommendations. The main reason: people don't feel an immediate improvement and revert to their old habits. The general advice to "eat less sugar" doesn't change anything because it doesn't specify what exactly needs to be done. In his practice, Stoianov observes that when explanations are linked to consequences visible to the patient (from a stain on a tooth to darkening along the edge of a filling), and when specific changes are described rather than general principles, motivation increases significantly. It is also important to explain that results won't be seen overnight, but within a few weeks, new lesions will stop appearing.

Author's contribution. The author independently developed a structured behavioral approach to caries prevention based on personal clinical practice, comprising a behavioral caries risk assessment system, an algorithm for identifying hidden (under-reported) risk factors, and a targeted behavioral correction plan integrated into a single preventive model.

Conclusions. Clinical analysis shows that the main risk factor for dental caries is not the total amount of sugar consumed, but rather how many times a day the teeth come into contact with an acidic environment. Patients with more than four such exposures per day had 30–50% more active lesions, even if they consumed no more sugar than others. The same chocolate, eaten all at once, results in a single acidic episode; the same chocolate, spread out over several hours,

results in a series of episodes. Nighttime snacking, sipping sweet drinks slowly, and skipping evening toothbrushing are the three habits most predictably associated with the progression of caries.

In patients with dry mouth, active caries appeared much more often. Stoianov recorded it in 60–80% of such cases, while among patients without salivary problems the rate was about 20–30%. If the patient had new lesions despite normal hygiene and no obvious dietary excesses, the next step was to check what could be reducing saliva. This included regular medication, mouth breathing, chronic stress, and general health factors. Only after that was the prevention plan adjusted.

Even if the diet is fairly balanced, plaque remains a separate problem. It still has to be removed regularly. Typical areas where plaque accumulates - the cervical regions, interdental spaces, and edges of fillings - maintain an acidic environment regardless of what a person eats. The patient's subjective assessment of their hygiene almost always differs from what the plaque staining reveals during an examination. Interdental cleaning reduces the incidence of lesions by 20–40%, but it is the least followed recommendation.

Behavioral change yields measurable results. Patients who followed the recommendations had two to three times fewer new lesions than those who made no changes. The first noticeable changes appeared within 1–3 months. According to Stoianov's estimates, 50 to 70% of new caries cases can be prevented without treatment, simply by changing diet and hygiene habits. But this is only possible when discussions about diet and behavior are part of every appointment, rather than happening if there's time left.

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