



A NEW FACE OF CARIES: INNOVATIONS AND APPROACHES IN DIAGNOSTICS

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Article history:	Abstract:
Received: March 26 th 2025 Accepted: April 24 th 2025	This article discusses the urgent aspects of early detection of caries disease and diagnostics through modern technologies, analyzing advanced diagnostic methods used to identify various forms of caries disease and assessing their effectiveness. The study involved an analysis of scientific literature, clinical observations, and the examination of modern technological tools, including DIAGNOdent, radiovisiography, and optical imaging systems[12]. According to the research findings, advanced diagnostic methods play a crucial role in the early detection of caries, accurate diagnosis, and the establishment of treatment strategies. In conclusion, the new "face" of caries—its development in a latent form without clinical signs—necessitates a fundamental shift in dental diagnostic approaches.

Keywords: caries, early diagnosis, DIAGNOdent, optical fiber technology, radiovisiography, clinical observation, latent caries, modern dentistry, enamel demineralization, non-invasive methods, early detection of caries, innovative technologies.

INTRODUCTION. In modern dentistry, the early detection of caries disease and accurate diagnosis are critical factors not only for effective treatment but also for maximizing the preservation of dental tissues. As the quality of life of the population improves, the demand for aesthetic standards, oral hygiene, and the level of medical services is also increasing. In such an era, the latent forms of caries and the initial stages that do not exhibit clinical signs often go undetected through traditional visual or palpatory examinations [3]. Traditional methods of caries diagnosis (visual assessment, probing, radiography) have many drawbacks, including subjectivity, delayed diagnosis, and the risk of unnecessary damage to dental tissues[13]. Therefore, new approaches based on non-invasive, highly sensitive, and reliable technologies are being widely implemented in modern dental practice. Innovative tools such as DIAGNOdent, optical imaging systems, radiovisiography, laser, and infrared technologies significantly enhance the possibilities for clinically detecting caries. This article analyzes modern diagnostic methods for caries disease, their advantages, practical effectiveness, and clinical significance. It aims to reveal which approaches are effective in identifying the new clinical "face" of caries—namely, cases developing in asymptomatic, latent forms [2].

Dental caries (Caries dentis) is a pathological process that occurs after the eruption of teeth, characterized by the demineralization and destruction of hard dental tissues, as well as the formation of defects within these tissues. It can be classified into several types based on its stage of development, location, and clinical appearance. In modern dentistry, caries is classified as follows[15]:

BASED ON THE STAGE:

Initial caries (in the form of enamel spots) – clinically appears as white or brown spots, with the enamel surface remaining smooth. At this stage, caries is limited to demineralization.

Surface caries – involves superficial damage to the enamel layer. It is accompanied by slight sensitivity and vague pain.

Medium caries – progresses to the dentin beneath the enamel. Pain intensifies with sweet or cold foods.

Deep caries – reaches the deeper layers of dentin. It is associated with severe pain and a risk of pulp damage.

BASED ON LOCATION:

Caries of the tooth crown (occlusal, proximal, smooth surfaces).



Caries of the tooth root – particularly occurs in older patients against the background of periodontal diseases.

Secondary caries (recidivism) – recurrent caries that develops at previously filled areas.

BASED ON PROGRESSION:

Acute caries – rapidly progressing, often seen in children.

Stabilized (inactive) caries – a non-active process, often expressed with darkly pigmented lesions.

Latent forms of caries.

In modern scientific approaches, the latent (subclinical) forms of caries are being studied with particular emphasis. Among these, the most dangerous type is interproximal caries, which may not be visible during visual examinations. Latent caries is one of the most obscure yet dangerous forms of caries in the oral cavity. Its main complexity lies in the fact that there may be no noticeable changes on the external surface of the tooth, while the internal layers, particularly the dentin, gradually begin to decay. In such cases, the patient may not experience pain or discomfort, making timely detection even more challenging. Latent caries is especially prevalent among young children and adolescents, as during this period, the tooth enamel may not be fully mineralized, and oral care may be insufficient [1]. Furthermore, it continues to develop until detected by advanced technologies—such as lasers or digital radiography—leading to decay within teeth that appear healthy at first glance. The failure to timely identify this type of caries can lead to complications such as deep caries, pulpitis, or even periodontitis[12]. Therefore, the early detection and treatment of latent caries remain pressing issues in modern dentistry [5]. The introduction of new diagnostic technologies and their active application in practice are key ways to effectively address this problem. In this context, technologies such as DIAGNOdent, infrared scanning, and radiovisiography become essential for detection.

INDICATORS OF CARIES DISEASE. The prevalence of caries is considered one of the indicators of caries disease. The prevalence of caries is reported to be around 90%. The prevalence of caries varies across countries. In Bulgaria, it ranges from 40% to 90%, in the USA it is 99%, and in Nigeria, it is 2%. In Uzbekistan, this indicator is between 73% and 80.5%[7].

In modern dentistry, the early detection of caries has become a crucial stage in treatment strategies. Traditional diagnostic methods, such as probing and standard radiography, are often ineffective in detecting latent caries lesions. Therefore, there is a growing need for innovative technologies based on non-invasive

methods. One such tool is the DIAGNOdent device. This laser apparatus allows for the early detection of the demineralization process of enamel. The device records the loss of minerals in tissues through infrared laser beams and determines the presence or absence of caries based on digital indicators. This technology is particularly relevant for cases of developing latent caries that do not exhibit clinical signs[4]. Additionally, tools based on optical fiber technology, such as Fiber-Optic Transillumination (FOTI) and Near-Infrared Imaging (NIRI), help identify damaged areas by illuminating dental tissues. Radiovisiography allows for the assessment of the size, depth, and location of caries lesions through digital radiological images. This method provides accurate results while ensuring safety through low-dose radiation exposure. The application of advanced diagnostic methods in conjunction with clinical observations further enhances the reliability of diagnoses. In modern dentistry, these approaches are widely used to personalize diagnostics and prevent excessive invasive interventions[6].

Global Prevalence of Caries.

The average prevalence rate of dental caries in permanent teeth worldwide is 33.6%, which corresponds to approximately 335 million cases. Among children, the number of untreated caries cases in primary teeth reaches 135 million, indicating a prevalence rate of 43.8%.

The European region has the highest prevalence of oral diseases globally, with 50.1% of the population affected. In Eastern Europe, the proportion of caries-free children aged 5-6 varies from 10% to 52%. For example, this figure is 10% in Lithuania and 52% in the Czech Republic[9].

In the Asia and Oceania region, the average prevalence rate of early childhood caries (ECC) is 52%. In Southeast Asia, the number of untreated caries cases in primary teeth among children aged 1-9 reaches 135 million, also indicating a prevalence rate of 43.8%. In the Philippines, the prevalence rate of caries among 5-year-old children is 85.2%.

In Kazakhstan, the prevalence of caries among children aged 12 and 15 is high, negatively impacting children's health. In Kyrgyzstan, the proportion of caries-free children aged 5-6 is low, indicating existing problems with oral health[11].

Among children aged 1-9 in Uzbekistan, the prevalence rate of untreated caries in primary teeth is 43.8%. For the population over 5 years old, the prevalence rate of untreated caries in permanent teeth is 28.7%[7].

CONCLUSION.



The early detection of dental caries is one of the most pressing areas in modern dentistry. Today, caries is not only viewed as visible damage to the tooth surface but also as a complex pathology that develops slowly within the body, often in a latent form. In particular, the latent form of caries can go unnoticed during diagnostic processes using traditional examination methods, leading to deepening decay within the tooth without the patient experiencing pain[9]. This situation necessitates timely detection of caries, the correct selection of treatment strategies, and the implementation of non-invasive approaches to treatment. Innovative tools such as DIAGNOdent, optical fiber technologies, and radiovisiography provide the opportunity to detect latent caries from the early stages.

Furthermore, the analysis of global and regional statistical data indicates that caries remains a prevalent problem in many countries, including Uzbekistan, Asian countries, Europe, and worldwide[10]. Therefore, the introduction of advanced technology-based diagnostic tools in dental practice, regular preventive examinations for patients, and increasing public awareness of oral health should be regarded as important strategic tasks to ensure the early detection of caries. This approach not only enhances the effectiveness of disease treatment but also serves as a solid foundation for building a healthy society.

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