MODERN METHODS OF CARIES DIAGNOSIS AND TREATMENT

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Abstract: This study examines contemporary approaches to caries diagnosis and treatment, including a discussion of cutting-edge technology and examples of hardware diagnostic techniques. They are contrasted with one another, and the benefits and drawbacks of each approach are considered.

Keywords: electrical impedance spectroscopy, optical coherence tomography, diagnostics, caries, and laser fluorescence efficiency.

Introduction:The work's goal is to conduct a comparative analysis of caries diagnostic techniques.

Caries is one of the most common illnesses in the world today, affecting over 95% of the population. In contemporary dentistry, the diagnosis and prevention of carious process development are still regarded as significant and poorly understood issues. It has been shown that caries is a multi-phase process that necessitates a mix of risk factors and cavity formation time. At a dental visit, it is often not able to identify the carious process or the risk of caries. Most of the time, a patient already has cavities when they see the dentist, necessitating the preparation of tooth tissue and subsequent filling. Today's dentists must optimize the preservation of their own tooth tissues in order to stop the disease process before it starts. There are a number of objective tests (COSRE, TER-test, and CRT-test) and caries detection techniques (basic and extra), however when used independently, they are questionable and uninformative. One of the most pressing issues facing contemporary dentistry is the

need for a quicker and easier method of diagnosing dental cavities in their early stages.

One of the most prevalent dental diseases that afflict individuals of all ages is caries. Early disease detection and sparing treatment are now feasible because to the quick development of modern caries diagnostic and treatment techniques. This article examines cutting-edge diagnostic techniques such as electrical impedance spectroscopy, optical coherence tomography, and laser fluorescence. Additionally examined are contemporary therapeutic approaches such enamel infiltration, laser preparation, and remineralizing therapy.

Caries is a disease condition caused by bacteria that demineralizes and destroys the tooth's hard structures. More than 90% of adults have dental caries, according to the World Health Organization (WHO). Invasiveness and the need to remove a sizable portion of the tooth tissue are two drawbacks of traditional diagnostic (visual examination, radiography) and therapeutic (preparation and filling) techniques. In this sense, the creation of novel diagnostic and treatment strategies that reduce intervention and maintain healthy tissues is an important area of contemporary dentistry.

A crucial component of clinical medicine is diagnosis; without it, a diagnosis cannot be made, which makes it difficult to prescribe therapy and preventative measures later on. Early diagnosis, while the patient has no symptoms, is crucial for the discovery of caries. This is because faults that have already been identified are simpler to fix, making it feasible to stop the pathological process from progressing. In all age groups, the severity of dental caries may rise from a CPUE of 2.7 (2004-2006) to a CPUE of 3.5 (2011) [2] due to the early presentation of the carious process in the absence of diagnosis. It should be considered that the study of contemporary diagnostic techniques and their subsequent use to identify the early phases of the carious process constitute the primary answer to this issue.

1. Contemporary caries diagnosis techniques

1.1 DIAGNOdent, or laser fluorescence

1.2 The DIAGNOdent diagnostic instrument (KaVo, Germany) uses laser fluorescence to identify changes in the structure of tooth tissues during demineralization, primarily on the occlusal surfaces of teeth. The device's laser photodiode delivers red radiation, or light waves with a length of 655 nm, onto the tooth surface with a threshold power of 1 mV. The light is absorbed by the tooth's hard tissue's organic and inorganic compounds, and the gadget reflects it in the infrared spectrum. Consequently, the gadget provides numerical figures and emits an auditory alert. Prior to diagnosis, the tooth should be cleaned and dried for better reading accuracy. The gadget may provide inaccurate results if there is a lot of plaque or poor dental hygiene. This method's primary benefits are its simplicity, lack of hazardous ionizing radiation, ability to identify fissure caries, and ability to detect concealed carious cavities. Additionally, the severity of the sickness may be readily determined with the use of sound and digital identification. However, as it is often not feasible to insert the instrument's tip into the interdental space, the device is not meant for the diagnostics of tooth contact surfaces. The device's range of applications is greatly diminished as a result [20–22]. The Quantitative Light-induced Fluorescence (QLF) approach provides an additional choice for diagnosing dental cavities. The basis for the Quantitative Light-induced Fluorescence device is the fact that demineralization reduces the fluorescence of dental hard tissue. The device is a portable intraoral system that replaces the laser source with a filter system and an incoherent light source. A liquid-filled light guide transmits the blue light produced by the light-emitting device, which has an intensity of 370 nm. The pulsed blue light is absorbed by the tooth throughout the examination, causing decaying teeth to glow red and healthy teeth to glow green. Using a video camera and a high-pass filter, the picture of the fluorescing tooth is sent to the display. A color picture of the patient's oral cavity's state is shown on the screen. Due to the decrease of

fluorescence in demineralization zones, the device may identify carious lesions early. It can also determine the location, size, and depth of the carious cavity, as well as the severity of the pathological process. In order to prevent the progression of the carious process at an early stage and to ease treatment by using non-invasive procedures without preparation while preserving the tissues of the patient's teeth, new caries diagnostic techniques will be introduced into clinical practice. One of the most precise and non-invasive techniques for identifying dental cavities is laser fluorescence. Under the impact of a laser, demineralized tissues may generate fluorescent light, which is the basis for the working concept. Early detection of carious lesions is made possible with the DIAGNOdent instrument, particularly in difficult-to-reach places like molar fissures.

Benefits of the approach

High diagnostic precision; minimal radiation exposure; and the ability to track the process's dynamics

1.2 Optical Coherence Tomography (OCT): This technique employs light rays and is comparable to ultrasound. Even little enamel degradation may be seen in the very precise real-time imaging of tooth anatomy that OCT offers. Benefits

High resolution; absence of ionizing radiation; and early lesion detection

1.3 Spectroscopy of Electrical Impedance (EIS)

The technique relies on determining the tooth tissue's electrical impedance. Because affected regions have different electrical conductivity characteristics, demineralization may be diagnosed with a high degree of precision.

2. Contemporary caries treatment techniques

2.1 Infiltration of enamel (ICON-technology)

The goal of infiltration therapy is to treat the early stages of dental cavities without removing tissues mechanically. The technique is based on using a polymeric

substance that seals the damaged region by penetrating the porous enamel. Benefits include: - High aesthetics; - Preservation of healthy dental tissue; - Painlessness of the process

2.2 Preparing for laser

The conventional drill is progressively being replaced with laser technology. By precisely removing carious tissue, lasers (such Er:YAG) lessen patient suffering. Benefits of the approach

The laser's sterilizing action, little harm to adjacent tissues, and lack of pain

2.3 Remineralizing treatment

By using preparations that include calcium-phosphate, hydroxyapatite, and fluoride, the demineralization process may be halted and the enamel strengthened. In conclusion Therefore, the use of novel caries diagnostic techniques in clinical practice will both prevent the progression of the carious process at an early stage and enable treatment via the use of non-invasive procedures without preparation while maintaining the tissues of the patient's teeth.

In addition to enabling early disease detection, the use of contemporary caries diagnostic and treatment techniques also enables less invasive treatments. Biomimetic materials, infiltration methods, and laser technologies bring up new possibilities in dentistry by extending tooth life and successfully combating cavities.

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