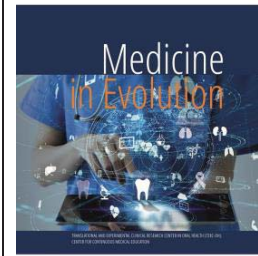


# Identifying incipient caries process



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## Abstract

Due to the high frequency of caries lesions within the population and due to the lack of a clear caries diagnosis protocol, new powerful methods of clinical investigation were developed. The purpose of this study was to underline the importance of detecting the incipient caries process with the help of a VistaCam iX intraoral camera, as the majority of initial processes remain undetected clinically and radiologically. VistaCam iX, designed by DÜRR DENTAL used the intraoral camera as therapeutic support for future dental treatments. The interchangeable heads mechanism (cam, proof, macro, poly, proxi) allows the camera to be used in several ways.

**Keywords:** caries process, VistaCam iX, intraoral camera

## INTRODUCTION

Due to the high frequency of caries lesions within the population and due to the lack of a clear caries diagnosis protocol, it is necessary to know the numerous devices used to detect an incipient caries lesion. New powerful methods of clinical investigation were developed to allow the identification of the cavities process from its initial stage.

### *Aim and objectives*

The purpose of this study was to underline the importance of detecting an incipient caries process with the help of a VistaCam iX intraoral camera, as the majority of initial processes remain undetected clinically and radiologically. Oftentimes, marmorations and pigmentations of the grooves and fossas are mistaken with a caries process or, in the case of deep grooves, the caries cannot be detected timely.

## MATERIAL AND METHODS

For this study we have registered a number of 23 patients aged between 19 and 34, who came to the Preventive Dental Medicine Discipline. Each patient was examined carefully, obturations and incipient caries were identified by inspection and probing. Then, in order to make a correct diagnosis, to identify all incipient caries, each patient was scanned using all the VistaCam iX modules.

VistaCam iX is designed by DÜRR DENTAL. It uses an intraoral camera that provides therapeutic support for future dental treatments, due to the intraoral images, it helps patients to understand more easily the importance and necessity of the treatment, and last but not least, providing images before and after treatment.

The interchangeable heads mechanism (cam, proof, macro, poly, proxi) allows the camera to be used in several ways. In DBSWIN, the caries and dental plaque filters show the activity of caries using a grey scale with numeric assessment from 0 to 3. This system allows the early detection of any incipient caries, and also calculates their depth.

The role of the intraoral camera is to provide images inside the oral cavity and information on the patient's odonto-parodontal status, offering patients a better understanding of the health conditions of their teeth and parodontium. The patients observe easily the structural changes of the enamel, which changes its color, texture or the occurrence of overflowing obturations (Fig. 1.). This way, the patients becomes aware of the lesions they have and also become cooperative.



Figure 1. (a - i). Incipient caries process detected using an intraoral camera

The macro camera helps to zoom in the image by up to 120 times. It can be used to detected incipient caries at the level of grooves and fosses, undetectable with the naked eye,

inter-dental caries and marginal closures incorrectly adapted or affected by secondary caries (Fig. 2).



Figure 2 (a-e). Macro aspect of caries lesions

The poly camera helps to photopolymerise dental materials, being equipped with LED technology and soft-start function. The action time is 20 seconds after activation, and every 5 seconds the light is intensified. This camera functions similarly to a photopolymerization lamp.

The proof camera helps to detect the caries process bacterial plaque, graded using a color scale. Healthy enamel is green, and the violet LED stimulates bacteria to color red, and measures the depth of the caries process (Fig. 3). As the proof camera also identifies bacterial plaque, it is advisable to have the teeth to be investigated cleaned professionally before scanning.

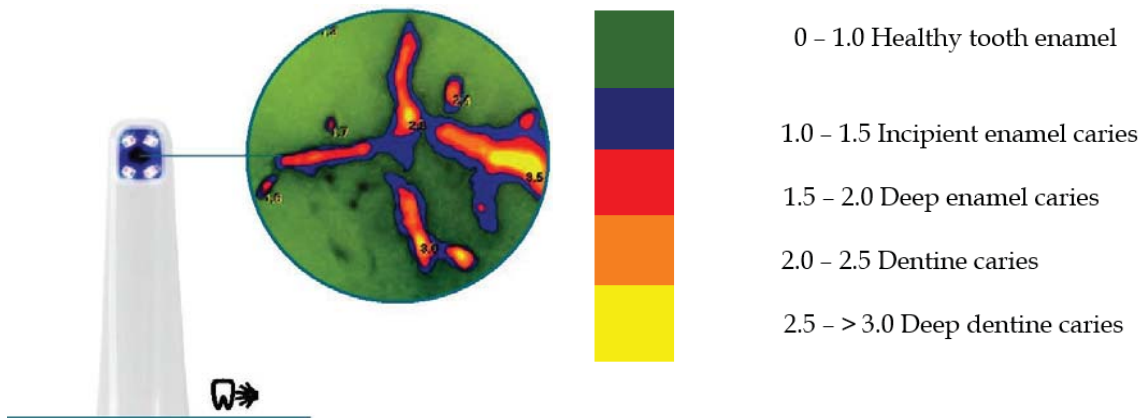


Figure 3. Proof camera color scale

The following figures show incipient caries processes detected using the VistaCam iX Proof, also indicating the depth of the caries process.

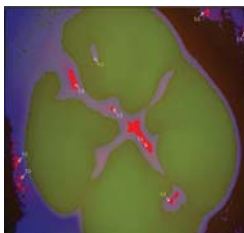


Figure 4. deep cavies process between 1.2-1.6 mm at 3.7

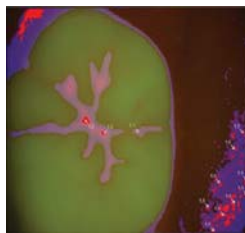


Figure 5. deep cavies process between 1.3-1.5 mm and 4.7

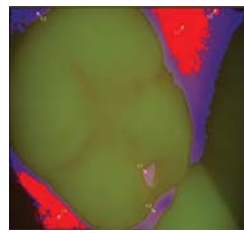


Figure 6. 1.5 mm deep cavies process at 1.7

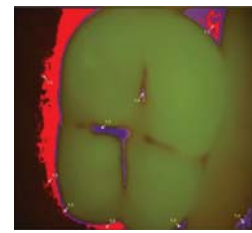


Figure 7. deep cavies process between 1.4-1.5 mm at 4.7

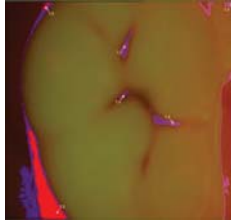


Figure 8. deep caries process between 1.4-1.5 mm at 4.8

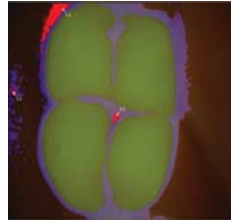


Figure 9. 1.6 mm deep caries process at 3.7

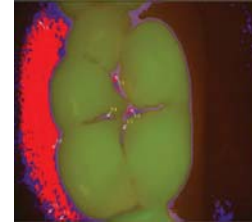


Figure 10. 1.3-1.6 mm deep caries process at 4.6

The proxi camera uses laser technology to detect inter-dental caries process, making healthy enamel translucent, and the caries process appear slightly opaque.

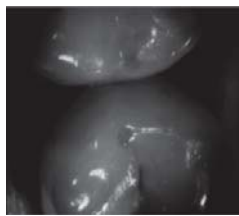


Figure 11. here are two opaque distal and medial areas indicating a caries process at 3.4 - 3.5



Figure 12. here is an opaque area around obturation at 1.2. and an opaque medial area indicating an incipient caries process at 1.3



Figure 13. here are opaque distal and medial areas indicating a caries process at 1.4.-1.5



Figure 14. here is an opaque area indicating a caries process at 3.4. and an opaque occlusive area indicating a caries process at 3.5

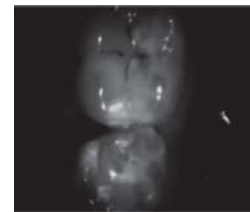


Figure 15. 4.5 here is an opaque area along the lingual cuspid indicating a caries process at 4.5. an opaque medial area indicating a caries process at 4.6

## RESULTS

Clinicians have at their disposal a series of methods in order to make a correct diagnosis of caries lesion, however they generally use visual inspection and probing, results which are supplemented with radiography analysis. These methods have most often proven to be insufficient due to the existence of hidden caries. That is why it is better to use additional methods of investigation in order to be able to observe the caries process as early as possible.

Epidemiological studies have revealed the importance of the biological age in caries lesions pattern. With primary teeth, the lesions appear predominantly on the occlusive surface of the first permanent molars up to the age of 12, thereupon on proximal surfaces.

Following the clinical examination of the 23 patients, a number of 52 caries were detected by visual inspection and probing. After the scan with VistaCam iX, another 58 incipient caries were detected, both on the occlusive surfaces of grooves and fossas, as well as inter-dental. This significant number demonstrates the importance of adequate and incipient diagnosis of caries lesions and is a real challenge for any dentist.

As complementary diagnosis methods, dentists have at their disposal several alternatives, which can be selected according to possibilities:

- Laser-induced Fluorescence – LF
- Quantitative Light-induced Fluorescence – QLF
- Fibre Optic Transillumination – FOTI and DiFOTI
- Optical Coherence Tomography – OCT
- Polarization Sensitive Optical Coherence Tomography – PS-OCT
- Polarized Raman Spectroscopy – PRS
- Transillumination with Near-Infrared light – TI-NIR
- Infrared fluorescence - IR fluorescence
- Near-Infrared reflectance imaging – NIR reflectance imaging
- Terahertz Pulse Imaging Multiphoton imaging – TPI
- Time-Related Single-Photon Counting Fluorescence Lifetime Imaging – TCSPC

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## CONCLUSIONS

The classical examination using visual inspection and probing (supplemented by classical radiologic examination) has most often time proven insufficient in the case of hidden incipient caries. An efficient diagnosis system for caries lesions should detect both incipient and extended caries lesions. A correct examination should provide objective information on the existence and severity of the lesion. Any method should be used only on surfaces cleaned in advance to avoid false positive measurements.

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