



## Caries Excavation by Using Fluorescence Methodology : Review

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### Abstract

Dental caries is progressive damage to the teeth caused by microbial organisms and is also most common disease affecting 80% of the population. Now a days, Restorative dentistry has moved away from a “drill and fill” philosophy to a minimally invasive approach. Several decades ago, increased Auto fluorescence has been found in the carious dentin which was supposed to be emitted by bacterial metabolites, and developed a novel caries excavation device based on fluorescence properties of dentin. Fluorescence is a visible light system that offers the opportunity to differentiate infected dentin and sound dentin using two forms of fluorescence Red and Green. The improved removal of infected dentin achieved using this new technique may be appealing to the clinician. Because it reduces the clinical working time. This also puts the dentist in a position to make an “informed decision” for the first time regarding the removal of carious dentin near the pulp.

**Key Words:** Fluorescence, Dental Caries, Infected Dentin, Caries Excavation

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### INTRODUCTION

Dental caries, also called as tooth decay, it is one of the most prevalent chronic diseases of people worldwide<sup>1,2</sup>. Restorative dentistry has moved from the extension-for-prevention concepts and to minimal intervention dentistry. Now a days there are numerous caries excavation methods available in the market to dentist Which includes chemomechanical agents, air abrasions caries disclosing dyes, conventional mechanical caries removal using hand or rotary instruments, lasers<sup>4-7</sup>. Restorative dentistry has gone away from a “drill and fill” philosophy to a minimally invasive approach.<sup>8</sup> while removing the dentinal caries to remove the infected dentin, preserve the affected dentin and detection of the end point of caries to restore the tooth is always troublesome to the dentist. In 1976 Sato and Fusayama proposed a special dye to ease this

decision<sup>9</sup>. Caries Detector, Using this dentists are able to effectively differentiate the infected dentin which has a deep red color from the affected dentin which is stained just slightly red or pink<sup>10</sup>. However, this approach to stain the carious lesion with Caries Detector as a marker of the active lesion reported to be more or less subjective and could lead to over-excitation<sup>11</sup>. Several decades ago a red autofluorescence of the carious dentin which was supposed to be emitted by the bacterial metabolites, was detected as infected dentin in caries excavation.<sup>12-14</sup> A novel approach to caries excavation, a device based on the fluorescence properties of carious dentin. They named this method fluorescence – aided caries excavation (FACE). It helps the clinician to directly assess the level of bacterial infection in dentin during excavation without the need for dye<sup>15</sup> Carious lesions are excited with a special light at 405 nm and can emit a red-orange fluorescence, which

allows dentists to detect the bacteria-infected tissue conveniently. And this red-orange fluorescence is claimed to be a visible aid to differentiate infected and affected dentin<sup>14</sup>

### **WHAT IS FLUORESCENCE:**

Fluorescence is the property of emitting electromagnetic radiation in the form of light as the result of the absorption of light. Fluorescence is emission of visible light by a substance that has absorbed light of a different wavelength. Which has property of absorbing Short wavelength light and emitting longer wavelength light.

### **FLUORESCENCE AIDED CRIES EXCAVATION:**

A clinically relevant method for assessing both quantify the infected dentin remaining in the cavity after excavation and assess the amount of dentin that has been removed. In the past, culturing methods have been used to quantify bacteria in dentin.<sup>17,18</sup> recently described caries excavation technique fluorescence aided caries excavation [FACE] enables the clinician to directly assess the level of bacterial infection in dentin during excavation without need for dye, this should allow selective removal of infected dentin thus preserving non infected dentin. While it has been shown that face removes bacterially infected dentin more successfully than conventional excavation.<sup>15</sup> The advantage of the FACE is red-orange auto fluorescence of carious dentin is totally different from the green color of the sound dentin.<sup>12</sup>. For this reason, FACE is used as a direct method to differentiate between infected dentin and with substantial demineralization clinically. FACE has better effectiveness and working efficiency in the infected dentin in of both permanent and primary teeth than other excavation methods.<sup>19-21</sup>

### **PRINCIPLE AND MECHANISM OF ACTION:**

**This** method showed the highest specificity, sensitivity Predictive values for residual caries detection, when evaluated using confocal microscopy.<sup>23</sup> auto fluorescence of the tooth altered by the changes in mineral content of the dental hard tissues. Increased porosity due to subsurface enamel lesion scatters the light either as it enters the tooth or as the fluorescence

emitted, resulting loss of its natural fluorescence. We can detect and measure the changes in enamel fluorescence of tooth when the tooth is illuminated by violet-blue light (290-450nm wavelength).from a camera hand piece. The following image captured Using camera fitted with 520 nm high pass filter. The 370 nm excitation light was replaced by a violet light of 405 nm which is optimal wavelength for the fluorescence emission by porphyrins<sup>13</sup>. and 520 nm yellow glass filter supposed to be helpful in differentiation the red –orange fluorescence of infected carious dentin from green fluorescence of sound dentin. Metabolites (porphyrins) produced by several types of oral bacteria are supposed to be the major contributor to this auto fluorescence. The QLF equipment is comprised of a light box containing a xenon bulb and a hand piece, similar in appearance to an intraoral camera. light is passed to the hand piece via a liquid light guide and the hand piece contains the band pass filter.<sup>21</sup> Live images are displayed via a computer and accompanying software enables patient's details to be entered and individual images of the teeth of interest to be captured and stored. QLF can image all tooth surfaces except inter- proximally. Once an image of a tooth has been captured, the next stage is to analyze any lesions and produce a quantitative assessment of the demineralization status of the tooth. The FACE method also provided to be very efficient, they need less time to excavate caries and no need of change instruments, apply of chemical agents, no need of test the cavity with an explorer.<sup>19</sup> the increased caries removal efficacy off FACE was apparently not associated with an increased cavity size or over extension of cavity.<sup>20</sup>

### **FACTORS INFLUENCE THE FACE:**

a) White ambient light minimizes the red-green contrast for evaluating the tooth fluorescence. therefore recommend switch off operating light and avoid sun light or bright room light. b) lighting reduces the red fluorescence, direct illumination of the cavity with FACE is important for proper results. c) use of antibiotics , anti microbial mouth rinses( such as chlorhexidine) or ozone might affect the bacterial contamination of the carious lesion and thus the production of red – fluorescing

porphyrin compounds. d) the use of staining materials can also negatively influence the diagnosis of residual caries diagnosis generally exhibit a strong fluorescence and in that way distort the visual impression with FACE.

#### **LIMITATIONS OF THE FACE:**

a) Visible violet light was used for excitation with FACE, may prove to be dangerous for clinician and patient associated with ultraviolet light or lasers.<sup>19,20</sup> b) the red fluorescing metabolite compounds bleach out under long and intensive illumination with the excitation light and display less red fluorescence (photo bleaching). In such case the risk would be inadequate caries excavation. In order to reliably avoid this. It is recommended to limit the illumination of the cavity with the FACE light pen to the required time and not to exceed exposure time to more than three minutes.<sup>21</sup>

#### **CONCLUSION:**

It can be stated that FACE makes the diagnosis of residual caries more reliable and sets it on a new foundation based on bacterial contamination in dentin rather than hardness of carious dentin. Furthermore, the dentist can make the decisions freely, depending on the specific clinical situation, to the point upto which existing caries must be excavated. The improved excavation of infected dentin achieved using this new technique may be appealing to the clinician. Because it reduces the clinical working time. This also puts the clinician in a position to make an “informed decision” for the first time regarding the removal of carious dentin near the pulp.

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