Technological Advances in Detecting Occlusal Caries

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The concept of dental preparation has evolved considerably; the principles of GV Black have been supplanted by contemporary preparation designs that emphasize the conservation of tooth structure. This is predicated by the professional's use of technology and understanding of caries in the diagnostic phase. This article demonstrates the benefits of utilizing advanced technology for detecting occlusal caries prior to the initiation of comprehensive restorative treatment.

The diagnostic and treatment planning phase is an essential component of a comprehensive treatment strategy. Prior to any restorative treatment, a clinician must assess and evaluate a patient's oral cavity for risk related disorders (eg, dental caries). Although significant advances (eg, improved oral hygiene, fluoridated water supply) have been made in caries prevention, occlusal pit-and-fissure decay remains a major concern. Research indicates that a significant percentage of pit-and-fissure lesions go undetected using conventional protocols. With the advent of advanced technological tools,[1,2] detecting early occlusal decay has improved.

Traditional methods of diagnosing dental caries such as manual probing and radiographic evaluation are often ineffective in detecting enamel defects, as they may be too small or inaccessible to the diagnostic tool. Additionally, manual probing has the potential of stimulating caries due to the iatrogenic damage caused by the explorer. Radiographs (eg, bitewing x-rays), although effective in revealing advanced stages of decay, are unsuccessful in detecting early caries, especially in the complex anatomy of fissure areas.

Today, caries-detecting devices supplement the clinician's visual observation and represent an effective diagnostic and communication tool during the initial patient examination.

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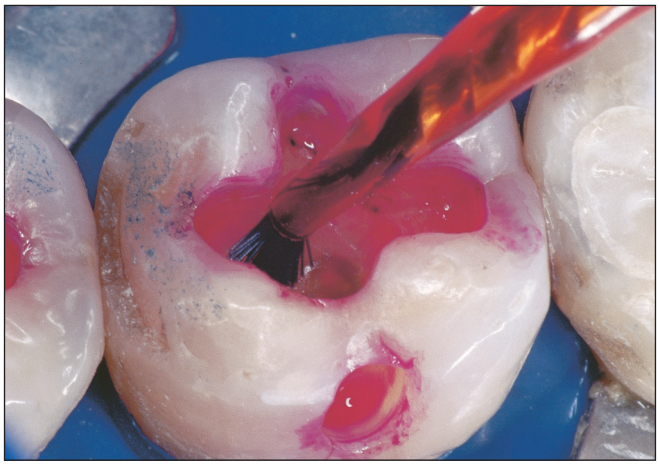

FIGURE 1. Use of caries-detecting solution aids in the identification of infected carious tissue and serves as a guide for its removal.

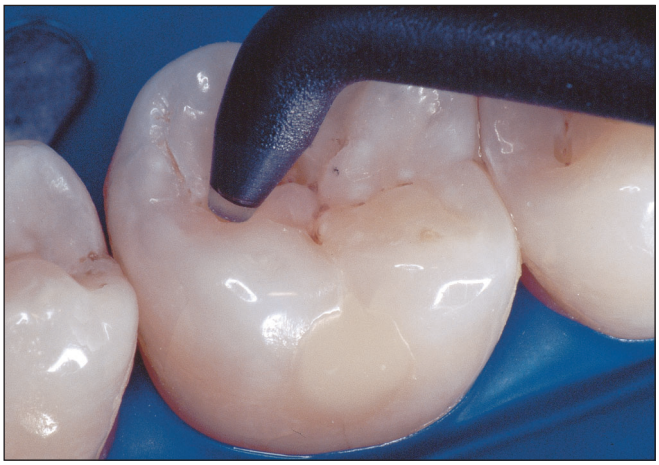

FIGURE 2. The fluorescence properties of enamel and dentin are altered by mineral loss and can be detected with the appropriate diagnostic tools.

Caries-detecting dyes are used in order to distinguish between affected and infected caries (Figure 1); they are an effective guide for the removal of caries as well. The dye bonds to and stains the denatured collagen in the dentin, a by-product of the carious process. Routine usage without understanding the limitations may result in excessive removal of sound tooth structure and an increase in mechanical pulp exposure. The specificity of caries-detecting dyes for demineralization precludes their use in caries detection for examination in pits and fissures. Caries-detecting devices may also be used for the identification of cracks and partial calcification of endodontic canals.[2,3] Quantitative light-induced fluorescence (DIAGNOdent, Kavo, Lake Zurich, IL) utilizes laser light to measure laser fluorescence within a tooth structure and provides clinicians with a numerical reading of enamel density (Figure 2). Its two-way handpiece optics allows the unit to simultaneously quantify the reflected laser light energy. The low-level laser causes the metabolic byproducts of cariogenic bacteria to fluoresce. The fluorescence is captured, analyzed, and assigned a numerical value by the system's microprocessor. This numerical value is proportional to the extent of carious activity. Clean, healthy tooth structure exhibits little or no fluorescence, resulting in low scale readings. Carious tooth structures exhibit fluorescence proportionate to the degree of caries, yielding elevated scale readings on the unit's display. Detection of mineral loss from caries at an earlier stage may permit effective reversal of the carious process. Quantitative light-induced fluorescence should be used in conjunction with radiographic findings and the clinical judgment and experience of the clinician.[4,5]

These contemporary diagnostic modalities aid in monitoring the progression or assessment of caries, while preserving tooth structure, removing disease and restoring teeth without irreversible destruction. In addition, these diagnostic devices stimulate an understanding of the disease process by the clinician, as well as educate and involve the patient in treatment decisions, which may result in acceptance of appropriate preventive and restorative strategies in caries management, and improved patient compliance and oral health.[6]

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