

# Clinical Diagnosis of Dental Caries: A North American Perspective

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*Abstract:* This paper summarizes current trends in the clinical diagnosis of occlusal caries in response to the RTI/UNC review and reflects the dilemma felt by many dentists who understand the difficulty in accurately assessing the extent and activity of pit and fissure caries in many of their patients. They are unsure if they should be aggressive in instrumenting suspicious lesions and provide small restorations, some of which may not be indicated. Alternatively, should they wait until signs are more clear-cut and provide larger restorations? Discussed here is the advantage of practicing dentists who obtain immediate false-positive feedback when they instrument a tooth with no clinical caries and false-negative feedback when a recall patient exhibits progression of an equivocal lesion. They should be encouraged to use this feedback as part of their diagnostic procedure and explain to their patients the difficulty of providing an accurate and precise diagnosis with existing tests.

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*Key words:* occlusal caries, pits and fissures, caries management, hidden caries, caries diagnosis

This paper summarizes current trends in the clinical diagnosis of pit and fissure caries from the perspective of North American dentists in response to the RTI review document "Diagnosis and Management of Dental Caries." The paper reflects the dilemma felt by many dentists who understand the difficulty in accurately assessing the extent and activity of pit and fissure caries in many of their patients. They are unsure if they should be aggressive in instrumenting suspicious lesions and provide small restorations, some of which may not be indicated. Alternatively, should they wait until signs are more clear-cut and provide larger restorations?

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## Caries Diagnosis

The most common methods among U.S. dentists for the clinical diagnosis of pit and fissure caries are visual/tactile and visual inspection aided by radiographs.<sup>1</sup> There is also considerable interest in commercially available innovative diagnostic systems such as laser fluorescence.<sup>2</sup> One commercially available product (Diagnodent, KaVo Dental GmbH, Germany) has been reported to be used by 20 percent of Canadian dentists two years after its introduction.<sup>3</sup> This product was introduced to the U.S. market in spring 2000. It has been heavily promoted since then, and interest in such relatively expensive devices among practicing dentists reflects their concern as to the accuracy of current diagnostic methods. The RTI review concluded that the available evidence describing the validity of diagnostic

methods is poor; most U.S. dentists would probably agree, although many probably overestimate their diagnostic abilities. However, this rating may have been adversely affected by the reviewers' decision to exclude non-English-language publications. This exclusion will underestimate the body of evidence and may be a significant omission because many of the innovative diagnostic systems have been developed and evaluated by researchers in non-English-speaking countries.<sup>4</sup> A second limitation of the report is the requirement for histological validation of caries status. While ensuring a robust gold standard, this requirement presents a serious limitation for *in vivo* studies of permanent teeth. As the report's authors point out, it effectively limits the validity of *in vivo* studies to those on third molars and first premolars, and the fissure pattern and caries presentation of these teeth may not apply to other, clinically more significant, permanent teeth. Excluded from the report is useful work where investigators "dissect" the carious lesion to identify false positives.<sup>5,6</sup>

In consideration of this discussion, dental educators should emphasize to students and practitioners that current techniques have significant limitations and the tests should be interpreted with such knowledge.<sup>7</sup> This can easily be demonstrated by showing students examples of teeth with clinically similar appearance but different degrees of caries penetration. Overall, the probability is high that North American dentists have inaccurate beliefs regarding sensitivity and specificity of their occlusal caries identification techniques, causing them to overestimate their ability to diagnose correctly.

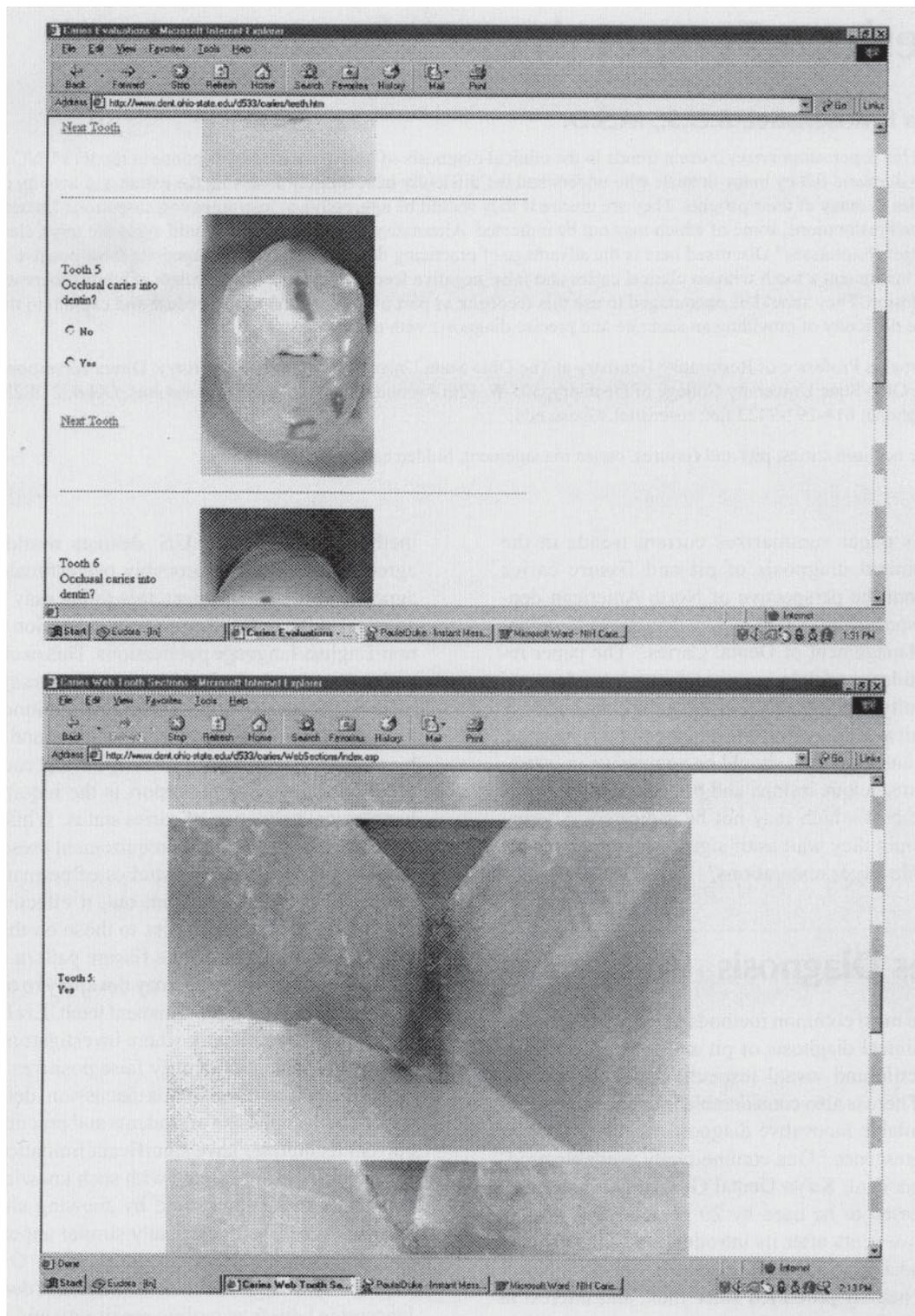


Figure 1. Web-based visual assessment of occlusal caries

## The Clinical Dilemma

Dentists often comment about the increasing difficulty of diagnosing pit and fissure caries in permanent posterior teeth, citing examples of so-called “hidden” lesions.<sup>8</sup> They are unclear when to intervene and can find no unequivocal clinical guidelines as to the management of stained pits and fissures.<sup>9</sup> Indeed, some continuing education speakers currently advocate instrumentation of *all* stained fissures. A recent web-based study of more than four hundred dentists has confirmed the difficulty in diagnosing stained occlusal fissures based on visual appearance alone.<sup>10</sup> The webpage included forms to collect responses to the question “occlusal caries into dentin?” for each tooth image (Figure 1). The mean correct diagnosis was 57 percent. Sensitivity was 83 percent and specificity was 46 percent—

similar values to published clinical studies with similar lesions.<sup>11,12</sup> It was concluded that web-based evaluations of stained occlusal fissures yielded diagnoses that had moderately high sensitivity and low specificity. If these judgments had been pursued clinically, they would result in a large number of unneeded restorative interventions.

Practicing dentists are aware of the choice between restorative intervention, with the risk of overtreatment, and “watchful waiting,” with the risk of supervised neglect. Most U.S. dentists appreciate that the penalty for overtreatment is considerably less than for undertreatment (Table 1). Financial rewards aside, contemporary restorative techniques, such as air-abrasion and adhesive restorative materials, permit very selective removal of only diseased or structurally compromised tissue.<sup>13</sup> These techniques are used to provide

**Table 1. Comparison of overtreatment with undertreatment of stained occlusal fissures in permanent teeth**

	<b>“Overtreatment” with preventive resin restoration</b>	<b>“Undertreatment” with remineralization strategies and watchful waiting</b>
<b>Immediate Advantages</b>	Increased knowledge of caries extent. Claimed patient preference. Additional fee to dentist.*	No restorative intervention needed. Lower cost to patient.
<b>Immediate Disadvantages</b>	Additional clinical procedure. Additional payment by patient and/or 3 <sup>rd</sup> party.	Uncertainty of caries extent. Variability of patient response No fee.*
<b>Long-Term Advantages</b>	Reduced likelihood of extensive carious lesions developing.	Reduced number of restorations requiring evaluation, maintenance, and replacement. Emphasis on prevention may reduce progress of other lesions.
<b>Long-Term Disadvantages</b>	Average lifetime of restorations is unknown. No well-developed guidelines for the replacement of suspicious preventive resin restorations.	Increased likelihood of extensive carious lesions requiring endodontic treatment. Strategy may require more frequent recall.

\* Under most current U.S. civilian dental practice reimbursement methods.

### CDT-2:

#### 01351 sealant—per tooth

Pit and fissure sealants have been documented by many studies to be a highly effective therapeutic measure for the prevention of dental caries.

#### 02385 resin—one surface, posterior-permanent

Includes preventive resin restoration with narrative description.

### CDT-3

#### D1351 sealant—per tooth

Mechanical and/or chemically prepared enamel surface sealed to prevent decay

#### D2385 resin-based composite—one surface, posterior-permanent

Used to restore a carious lesion into the dentin or a deeply eroded area into the dentin. Not a preventive procedure.

**Figure 2. Selected comparison of Code on Dental Procedures and Nomenclature published as CDT-2 (copyright 1994 American Dental Association) with The Code on Dental Procedures and Nomenclature published as CDT-3 (copyright 1999 American Dental Association)**

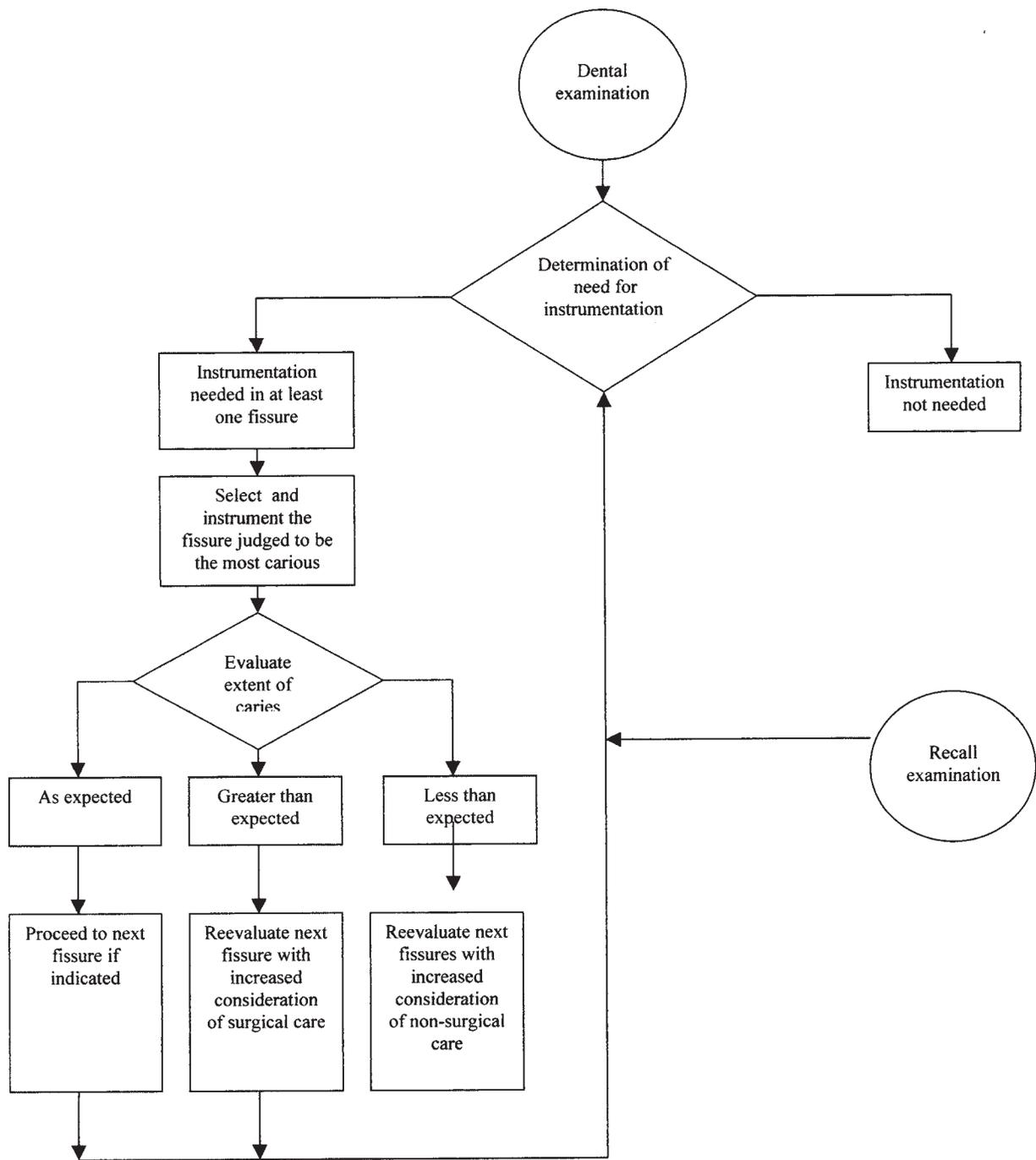


Figure 3. Management of pit and fissure caries

minimally sized, tooth-colored, preventive resin restorations<sup>14,15</sup> and have become very popular in contemporary U.S. dental practice, with dentists being increasingly urged to intervene earlier with the new techniques.<sup>16</sup> Recent amendments to the American Dental Association procedure codes reflect changes in the use of these restorations, for example, not permitting a dentist the “preventive resin restoration” code unless dentin has been removed (Figure 2).

Dentists and their patients also want to avoid the considerable costs of endodontic treatment and fixed or implant prosthodontics, should nonrestorative management of a “hidden” lesion be unsuccessful. There have been reports that patients prefer to have restorative intervention rather than employing more conservative measures.<sup>9</sup> However, it is far from clear that long-term studies will prove the effectiveness of such interventions, although some studies show considerable promise.<sup>17</sup> Practitioners still lack comprehensive information as to the long-term effectiveness of adhesive preventive resin restorative treatment.

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## Clinical Recommendations

Practicing dentists have an advantage over epidemiologists in that they obtain immediate false-positive feedback when they instrument a tooth with no clinical caries and false-negative feedback when a recall patient exhibits progression of an equivocal lesion. Dentists should be encouraged to use this feedback as part of their diagnostic procedure and explain to their patients the difficulty of providing an accurate and precise diagnosis with existing tests.

A rational approach to caries diagnosis in the absence of reliable tests may be to treat the susceptible surfaces as a unit rather than a series of unrelated clinical observations. The dentist could evaluate the risk factors for a particular patient and then identify the most likely fissure to be carious. If the dentist then decides a surgical intervention is justified, he or she can use feedback from that procedure, particularly the extent or absence of caries, to determine if additional intervention is indicated (Figure 3). Support for this approach may be found in studies that identify “examiner prediction of future caries activity” as a significant predictor of caries risk.<sup>18</sup>

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## Future Research Directions

The recommendations of the RTI review for future research directions provide useful guidance for

researchers seeking to advance the knowledge of caries diagnosis. For *in vivo* work, they recommend a standardization for histological validation methods for carious lesions. They also recommend a standard format for the reporting of clinical caries diagnosis trials. However, these recommendations do not overcome some of the problems inherent to *in vivo* studies of permanent teeth, particularly the requirement for extraction subsequent to the test. Information is obtained on a daily basis by dental practitioners when they determine the extent of suspicious lesions through operative intervention and when they recall patients previously deemed to not require operative intervention. Careful, well-designed, sampling of the outcomes of these procedures could be an important source for providing helpful clinical guidance.

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