

What Assessment Methods Are Necessary In School Programs To Determine Which Tooth Should Be Sealed?

Margherita Fontana, DDS, PhD
Indiana University School of Dentistry
Department of Preventive and Community Dentistry





“Clearly, since our diagnostic methods for assessing pit and fissure caries have been up to this time basically an educated guess, we must be placing sealants almost routinely over undetected incipient lesions” (Simonsen, 2002)



Indications for Occlusal Sealants

➤ On sound, at risk surfaces

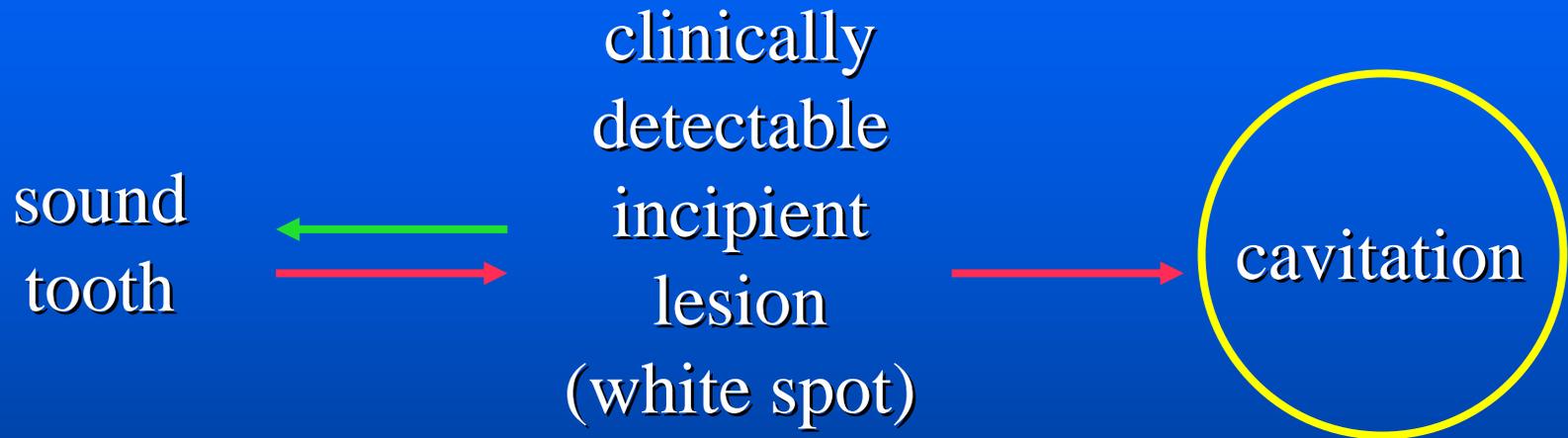


➤ To arrest questionable or non-cavitated (incipient) caries lesions



What is a non-cavitated caries lesion?

What are the Boundaries of Caries Detection and Intervention?



“Improved caries detection and diagnostic methods would help determine the appropriate **cutpoint or threshold** separating the **clinical decisions** to do nothing or preventively seal, or to therapeutically seal or surgically treat and restore”

(Weintraub, 2001)

- **What do we need to assess cavitation (if that is our threshold)?**
- **How accurate do we have to be?**

How clean must a cavity be before restoration? (Kidd, 2004)

Most operative textbooks state that once CAVITATION occurs, dentin will be heavily infected and then surgical measures must be taken to remove this “infected” tissue.

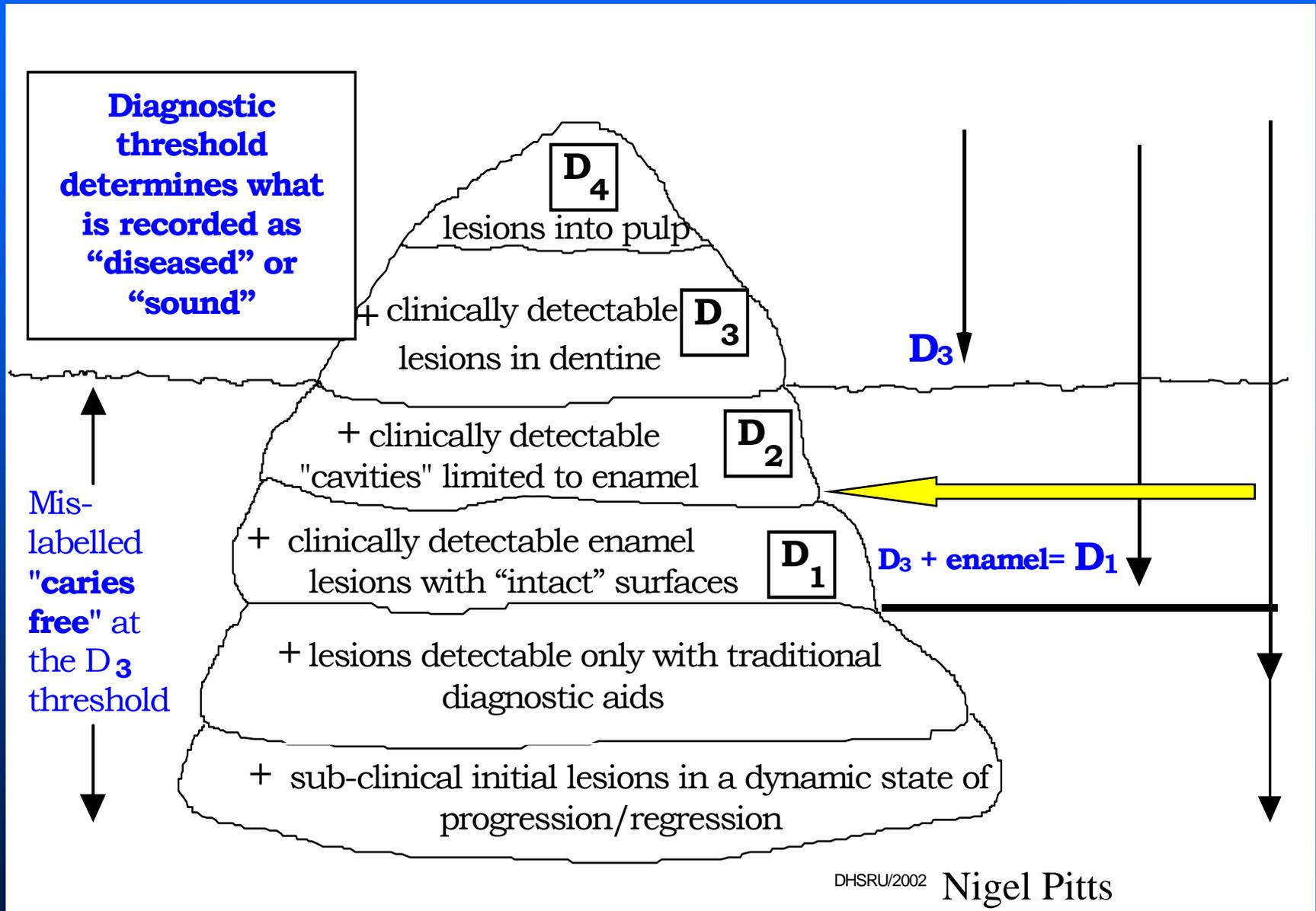
- Is this an irrelevant question?
- There is little evidence that infected dentine must be removed prior to sealing a tooth.
- Leaving infected dentine does not seem to result in caries progression, pulpitis or pulp death
- However, some bacteria survive. What is their fate?

Results show that active caries may become inactive and arrested if it is adequately sealed from the oral environment

Why not remove the biofilm (cause) and seal the hole in the tooth so that the patient can just clean, instead of removing the signs of the disease (demineralization)?

The “iceberg of dental caries”

Diagnostic thresholds in surveys, research & practice



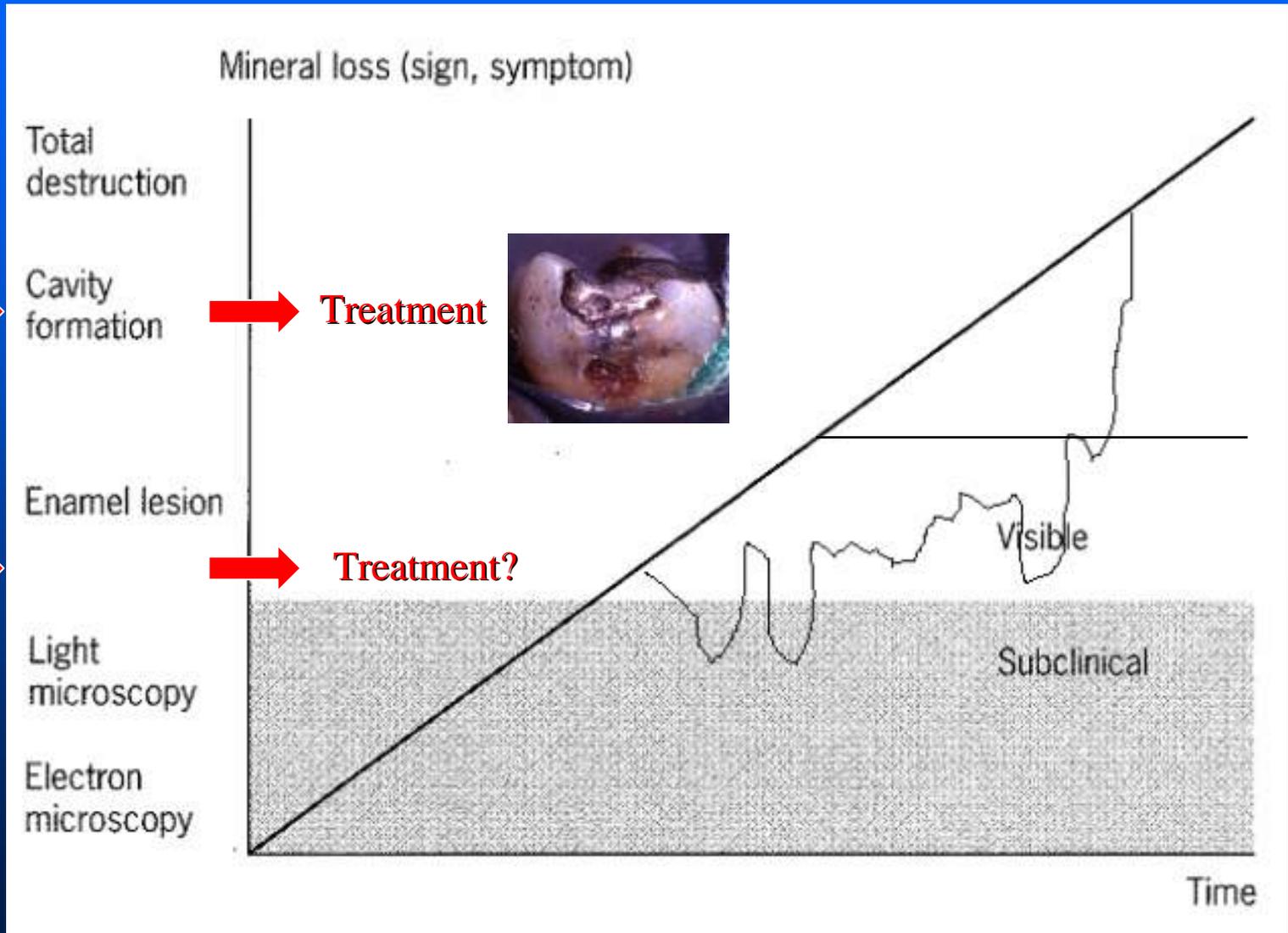
Progress of Mineral Loss/Detection

Disease →

→ Treatment

(White Spot) Disease →

→ Treatment?



**NATIONAL INSTITUTES OF HEALTH
CONSENSUS DEVELOPMENT CONFERENCE
Diagnosis and Management of Dental Caries
Throughout Life (March 26-28, 2001)**

“At this time the panel senses a paradigm shift in the management of dental caries toward improved **diagnosis** of **early non-cavitated lesions** and treatment for prevention and arrest of such lesions”

http://odp.od.nih.gov/consensus/cons/115/115_statement.htm

**What level of assessment
do we need for sealant
placement in School-
Based Programs?**



Stages of the Disease

Incipient or Non-Cavitated Caries Lesion:

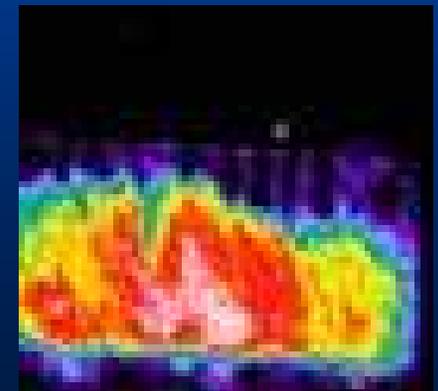
- 1) Demineralization of enamel **without evidence of cavitation** using clinical tools such as light, good eyesight, explorer (!), radiographs
- 2) Demineralization of enamel to the extent that the lesion can be positively detected
- 3) Demineralization of enamel such that the lesion is noncavitated and still reversible by biochemical means
- 4) The first readily detectable stage of demineralization using any available technology

White Spot



Internal
loss of
minerals

External
(outer)
surface



White Spot Lesion:

**It is a subsurface
lesion**

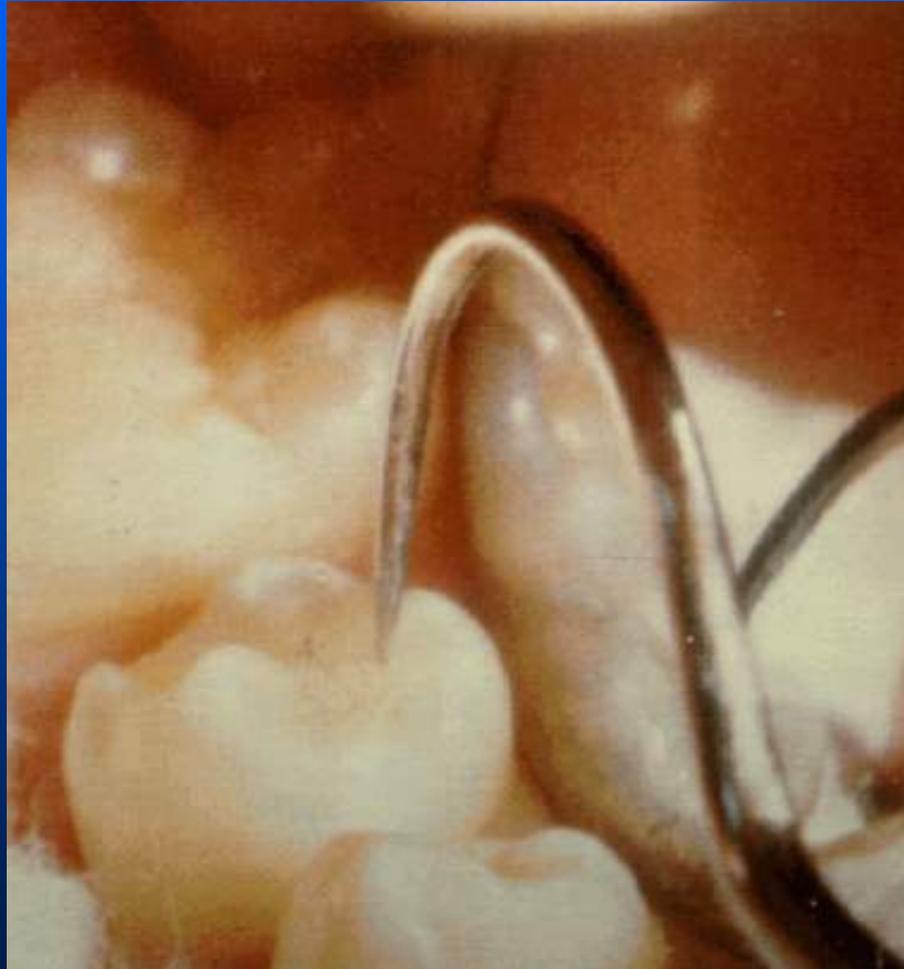
Stages of the Disease

Cavitated Lesion (Cavity):

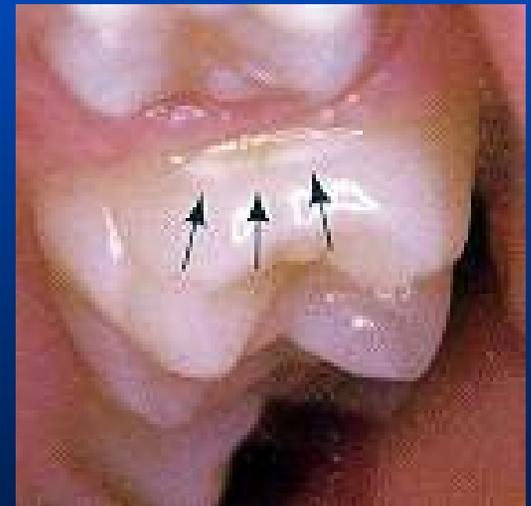
- ✓ A caries lesion that has lost the outer surface (leading to a discontinuity in the surface)



How do we detect caries lesions?



To **Diagnose** implies not only finding a lesion (**Detection**), but, most importantly, to decide if it is active, progressing rapidly or slowly, or already arrested. Without this information a logical decision about treatment is impossible (Kidd, 2001)



Purpose-Caries Detection

- Establish the level of destruction already present
- Aid in caries diagnosis (of the patient)
- Determine and support treatment decisions



Visual Examination

- Most widely used method, in dental offices, in clinical research and in epidemiological studies.
- Quick, cheap and easy.
- Should be performed on a dry, clean tooth, with good light, with a mirror.
- Useful on all surfaces and on all types of caries.
- The basis of most other detection, and most often compared to new methods.
- Standard on occlusal, smooth surface and root caries.
- Mostly dichotomous decisions: presence or absence.
- Usually no quantification of lesions and therefore difficult to monitor lesions.

Detection of Lesions



- **Sturdevant's (1985) textbook in Operative Dentistry:**
 - Defects are best detected when an explorer placed into a pit or fissure provides tug-back or resistance to removal.
- **Subject of controversy:**
 - **Use of the explorer does not add anything to the detection yield of the examination.**
 - The use of the explorer may at best be misleading and at worst be potentially damaging.
 - Use a **BLUNT** probe, proper lighting, dry, clean teeth and sharp eyes

Sensitivity of Visual Examination

Occlusal surfaces:

Typically low sensitivity, ~ 0.30, and high specificity

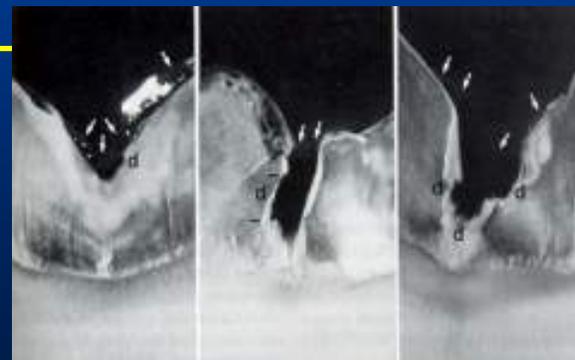
Detection method	Validation method		Totals
	Caries N=50	No Caries N=950	
Caries Present	TP True Positive N=20	FP False Positive- Overtreatment N=57	N=77
Caries Not present	FN False Negative- Undertreatment N=30	TN True Negative N=893	N=923
	Sensitivity: 40%	Specificity: 94%	

Alwas-Danowska
et al., 2002

Probing with Sharp Explorer...

Traditional probing with a sharp explorer has come into question as the ultimate determinant of caries activity. **The exclusive use of a “catch” by the sharp explorer to diagnose caries in pit and fissure sites should be discontinued** and clinicians are being called upon to use “sharp eyes and a blunt explorer.” Also **non-cavitated lesions can become cavitated** simply through pressure from the explorer during the typical examination. Thus, penetration by a sharp explorer can actually cause cavitation in areas that are remineralizing or could be remineralized. An explorer can also transfer cariogenic bacteria from one tooth surface to another.

Treating caries as an infectious disease. JADA 125 (June): 2-S to 15-S (1995)



Ekstrand et al., 1987

Appropriate Ways to Use the Explorer for Sealant Placement

- **Clean debris from fissures and interproximal spaces**
- **Confirm and assess cavitations (breaks in the continuity of the surface)**
- **Feel the texture (roughness) of non-cavitated lesions, if they extend well beyond the opening of the fissure (if the program desires to consider surface activity in their risk decision making process)**
- **Once sealed, help assess the quality and integrity of the sealant.**



Core ICDAS Criteria

- For use on coronal *and* root surfaces, *as well as* caries adjacent to restorations *and* sealants
- These unifying, predominantly visual, criteria code a range of the characteristics of clean, dry teeth in a consistent way that promotes the valid comparison of results between studies, settings & locations
- ICDAS criteria record *both enamel and dentine caries and* explore the measurement of *caries activity* in all three of the domains below



- The **ICDAS Detection codes** are in use now and are recommended
- The **ICDAS Assessment codes** are part of a developing research agenda
- The **ICDAS System** provides an evidence based framework to validate and explore the impact of existing and new-technology aids to caries “diagnosis”

ICDAS-2

<http://www.dundee.ac.uk/dhsru/news/icdas.htm>

DETECTION AND S

EXTENSIVE
CAVITY



ND



enamel

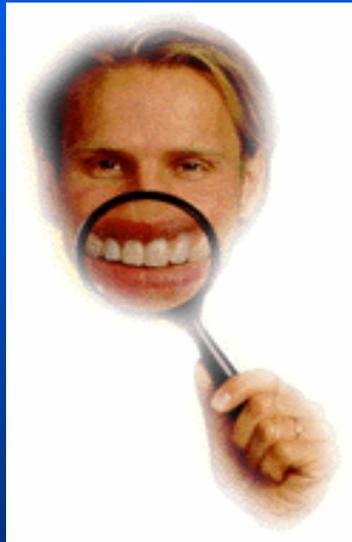
Enamel/
Dentin

Score
0

- **It must be emphasized that cleaning of the tooth surface and use of air are essential components in the use of these criteria, especially if differentiation between the lower categories (e.g., 0, 1 and 2) is considered necessary.**
 - If cavitation is the threshold for sealant placement, then for surface assessment teeth can be dried with cotton rolls, gauze, or compressed air
- **No magnification is required to make these calls.**
 - Magnification may be useful for surface assessment; sealant application; and retention checks; however, there is limited evidence in the scientific literature to support the adoption of magnification for visual assessment of tooth surfaces for sealant placement

- **Lussi (1993) compared unaided VE with that using 2x magnification, VE with bitewings, bitewings alone, and visual/tactile with gentle probing, and found that magnification did NOT significantly improve sensitivity.**
- **Forgie et al. (2002) found that using 3.25x loupes for occlusal and interproximal assessment sensitivity was significantly higher than unaided vision. Specificity and PPV were similar to unaided vision .**
- **However, although magnification is not necessary to detect lesions using the ICDAS-2 criteria, its use may affect the interpretation of the histological findings in relation to the criteria developed to correlate with it.**
 - For example, a category 2 tooth could be viewed as a category 3 under magnification, and this would result in more teeth being eliminated from consideration of sealants.

Role of Magnification in Determining Cavitation



Radiographic Examination



- ✓ Radiographs show that demineralization is present, but when looked at in one period of time they cannot determine **ACTIVITY**
- ✓ Incidence of interproximal lesions in 2-3 graders is low
- ✓ The ICDAS-2 criteria recognizes that some of the non-cavitated stages of the caries disease process may have already progressed into dentin
- ✓ If we decide to seal non-cavitated lesions, radiographs would not change the clinical treatment outcome, and there is no evidence to suggest that it will change the efficacy of the outcome, therefore, radiographs should not be considered necessary in these programs

A New Way to “Look” at Dental Caries

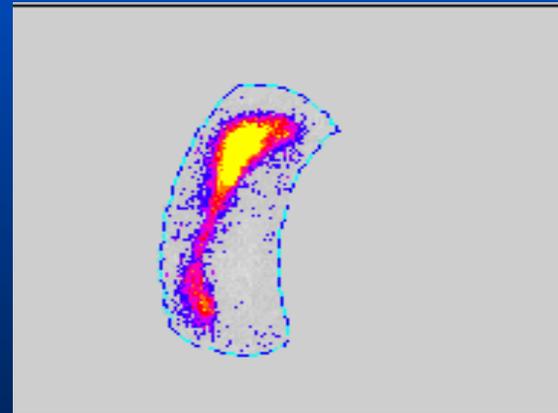


- Fluorescence methods
 - QLF
 - Infra-red Fluorescence
- Transillumination
 - FOTI
 - DiFOTI
- Electrical Conductance
 - ECM



Why new methods

Click on images to run video clips



Goals:

- Detect lesions early
- More reliably than before
- Quantification

Lesion Progression: Occlusal surface at 0, 4, 8, 12 months (QLF)

Infra-Red Fluorescence: Diagnodent®

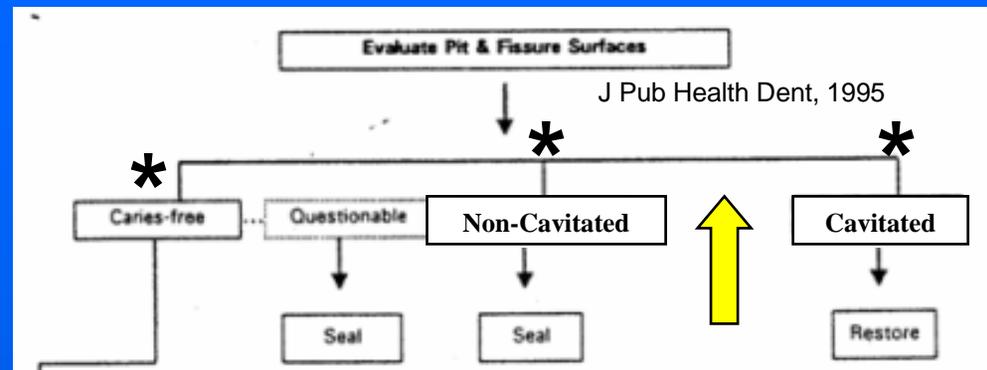
- **Bader and Shugars (2004): Systematic review conclusions for dentinal caries:**
 - Sensitivity is almost always higher than traditional visual methods (range 0.19-1)
 - Specificity is almost always lower (range 0.52-1).
 - “The increased likelihood of false positives compared with visual methods limits its usefulness as a principal diagnostic tool”
- **These methods do not assess differences between cavitation and non-cavitation**
- **If used routinely, the increase in false positives could reduce the number of teeth to be sealed**



Sensitivity of a Detection System- Low Caries Prevalence Population

Detection method	Validation method		Totals
	Caries N=50	No Caries N=950	
Caries Present	TP True Positive N=46	FP False Positive- Overtreatment N=133	N=179
Caries Not present	FN False Negative- Undertreatment N=4	TN True Negative N=817	N=821
	Sensitivity: 92%	Specificity: 86%	Lussi <i>et al.</i> , 2001

Summary



■ How do we assess cavitated vs. non-cavitated lesions?

- Visual assessment is appropriate
- Teeth can be dried with cotton rolls, gauze, or compressed air
- Explorer may be used to clean the fissures and “gently” confirm cavitations (i.e., breaks in the continuity of the surface); do not use sharp explorer under force
- Magnification (2x-4x) can be used, but is not required due to insufficient evidence on its effect in assessing cavitation
- Radiographs are unnecessary, especially in programs targeting children in grades 2 – 3
- Insufficient evidence to recommend other technologies to determine presence or absence of cavitation

Thank you...

