

Accuracy of Enamel Caries Lesions Diagnostic Methods: A Critically Appraised Topic

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Clinical Problem

- Dental caries is one of the most prevalent oral diseases affecting 35% of the global population.¹
- Early active caries into tooth enamel and outer dentin can be stabilized and stopped.
- Early detection of enamel lesions allows for non-invasive or minimally invasive treatments with a goal of remineralizing the tooth surface.²
- Many recent diagnostic technologies have become available to be able to discriminate between sound and diseased tooth surface.²
- However, studies looking at the diagnostic accuracy of each method have focused on a single or small number of technologies.
- Better comprehensive synthesis of the information on the comparative diagnostic accuracy of caries diagnostic technologies and methods is needed to help guide clinical decision of dentists.

Clinical Question

In permanent dentition, which caries diagnostic method to detect enamel lesions (e.g., visual-tactile, radiographic, fluorescence, transillumination) is more accurate compared with a reference standard method such as histology?

Evidence Search

- **MeSH terms used:** dentition, permanent; diagnosis; dental caries; dental enamel; sensitivity and specificity.
- **Key words used:** permanent, permanent teeth, perm*, diagnos*, diagnostic*, caries detect*, caries, carie*, enamel caries, initial caries, incipient caries, non-cavitated caries lesions, enamel, sensitivity, specificity.

Filters: last 10 years

Study design restrictions: systematic reviews, RCTs, meta-analysis, guidelines, clinical cross-sectional studies

Search Date: January 22, 2023

PubMed yield: 72 evidence sources

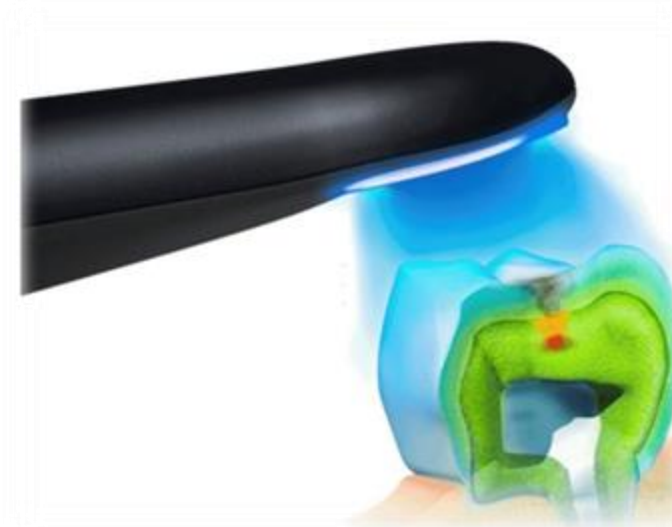
Additional searches: TRIP, ADA EBD, C.A.T.

Chosen source: Walsh T Macey R, Ricketts D, Carrasco Labra A, Worthington H, Sutton AJ, et al. Enamel Caries Detection and Diagnosis: An Analysis of Systematic Reviews. 2022.

Clinical Bottom Line

- There is low to moderate quality evidence showing that visual-tactile classification systems are a better method of choice for detecting enamel carious lesions. Radiographic assessment showed the lowest accuracy to detect enamel caries lesions compared to other diagnostic methods. However, due to accuracy results variation more within person longitudinal studies are needed.

Fluorescence (FL)



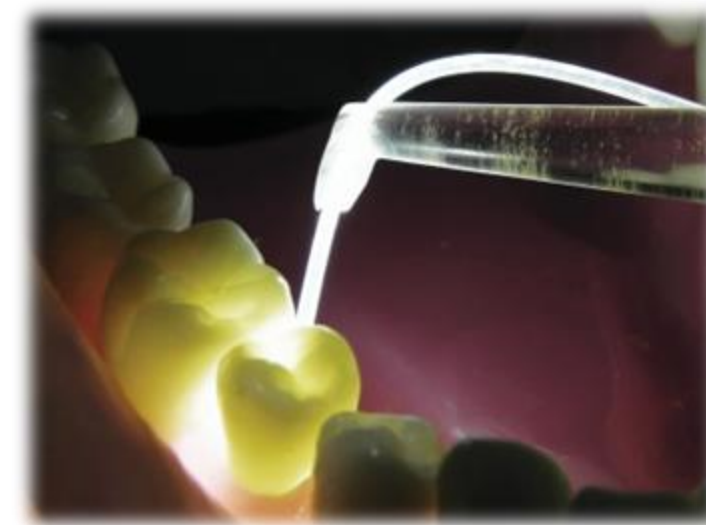
Visual-tactile classification (VT)



Imaging/digital radiograph (RI)



Transillumination & optical coherence tomography (TI)



Electrical conductance or impedance technologies (EC)



Clinical Applicability

- ❑ Lack of an objective non-invasive methodology for detection of dental caries.
- ❑ Current gold standard for detection of dental caries is histology analysis.
- ❑ Currently, clinicians do not have access to an objective assessment tool that can detect dental caries.
- ❑ Clinicians rely on subjective evaluation tool such as tactile and visual inspection.
- ❑ If tactile and visual inspection (ICDAS) is used appropriately by clinicians. The more diagnostic methods we use, the greater the chance of over treatment (sensitivity is increased but specificity is compromised).
- ❑ Investigating and discovering additional assessment tools for the detection of carious lesions can enhance clinical decision making among dentists.

Results

I] WP-WS analysis:

- ❑ Sensitivity estimate results were the highest for VT (0.82) and lowest for RI (0.48).
- ❑ Specificity estimates results were roughly similar for VT, FL and RI, and varied from 0.85 to 0.92

	LR+	LR-
VT	5.53	0.18
FL	5.96	0.33
RI	6	0.56

- ❑ Accuracy results were clinically meaningful for VT compared to FL and RI.

II] NMA analysis:

- ❑ Sensitivity estimate results were the highest for VT (0.83) and EC (0.83), and lowest for RI (0.50).
- ❑ Specificity estimates results varied from 0.81 to 0.89 with the NMA analysis for FL, VT, RI and TI, with EC being the lowest (0.72).

	LR+	LR-
VT	4.37	0.21
EC	2.96	0.24
FL	4.47	0.29
TI	4.22	0.29
RI	4.54	0.56

- ❑ Accuracy results were clinically more meaningful for VT compared to FL, RI, TI and EC.

Strength

- ❑ Large volume of data.
- ❑ GRADE system for certainty of evidence.
- ❑ Network meta-analysis (NMA) & Within-person within-study (WP-WS).
- ❑ QUADAS-2 tool for quality assessment of studies.
- ❑ Results retrieved from studies of 5 Cochrane diagnostic test accuracy systematic reviews.

Limitations

- ❑ Lack of within person studies.
- ❑ Not the same reference standard used across the studies.
- ❑ Publication bias not assessed.
- ❑ Diagnostic techniques evaluated mainly *in vitro* rather than *in vivo*.
- ❑ No PRISMA Flow Diagram.
- ❑ Low certainty of evidence.

Acknowledgement

We would like to thank Dr. Svetlana Tikhonova for all of the guidance and mentorship during this critical appraisal.

References

1. Marcenes W, Kassebaum NJ, Bernabe E, et al. Global burden of oral conditions in 1990–2010 - a systematic analysis. J Dent Res 2013;92:592–7..
2. Walsh T, Macey R, Ricketts D, Carrasco Labra A, Worthington H, Sutton AJ, et al. Enamel Caries Detection and Diagnosis: An Analysis of Systematic Reviews. J Dent Res. 2022;101(3):261-9.

