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DIAGNOSTIC APPROACHES TO DENTAL CARIES IN PATIENTS WITH DIABETES MELLITUS: A CONCISE REVIEW

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ABSTRACT

Diabetes mellitus (DM) alters the oral environment through hyposalivation, salivary acidification, and microbial shifts, which changes how dental caries should be diagnosed in this group. This concise review summarizes clinical, optical, and laboratory methods used to detect and assess caries in diabetic patients. Visual-tactile indices (DMFT/DMFS, ICDAS) remain the diagnostic backbone, while fluorescence-based devices (DIAGNOdent, QLF) and salivary/glycemic markers (flow rate, pH, HbA1c) add sensitivity for early lesions and disease-specific risk. A combined clinical–instrumental–laboratory protocol offers earlier, more accurate diagnosis than visual examination alone.

Keywords: dental caries, diabetes mellitus, ICDAS, laser fluorescence, saliva, HbA1c

INTRODUCTION

Diabetes mellitus affects nearly 1 in 11 adults worldwide, and 90–95% of cases are type 2 diabetes (T2DM). Its recognized oral complications include periodontal disease, salivary dysfunction, dental caries, and delayed healing. The DM–caries relationship is biologically plausible but epidemiologically inconsistent — some studies report higher DMF scores in diabetics, others find no difference — suggesting that caries risk depends more on disease duration and glycemic control than on the diagnosis of DM itself. This inconsistency motivates a review of which diagnostic tools best capture caries risk specifically in this population.

MATERIALS AND METHODS

This narrative review draws on clinical and diagnostic-accuracy studies from PubMed/MEDLINE and ScienceDirect addressing caries diagnosis in patients with type 1 and type 2 diabetes. Four categories of method were analyzed: clinical indices (DMFT/DMFS, ICDAS); optical/fluorescence devices (DIAGNOdent, QLF); radiography as a reference standard; and salivary/laboratory markers (flow rate, pH, HbA1c).

RESULTS

ICDAS is the recommended clinical standard, grading lesions along a severity continuum rather than as a binary finding, and is applied under standardized cleaning and drying protocols by trained examiners. Fluorescence-based devices add early-lesion sensitivity: DIAGNOdent uses 655 nm laser light to detect bacterial porphyrins, with device scores ≥30 indicating a need for restorative intervention, but it carries a higher false-positive rate than visual exam. QLF, using 405 nm autofluorescence, shows a higher sensitivity range for proximal caries (0.62–0.91) than visual inspection, radiography, or DIAGNOdent, as summarized in Figure 1.

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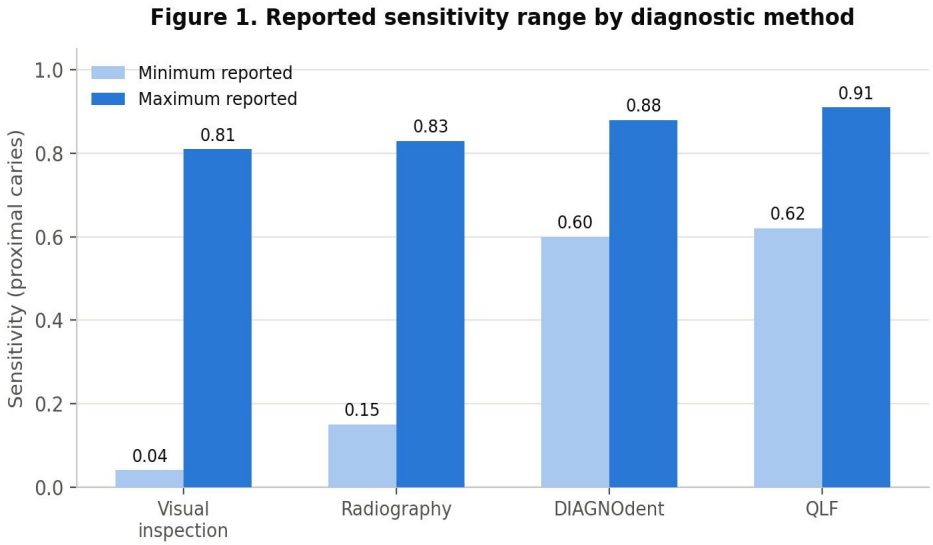


Figure 1. Sensitivity ranges of caries-detection methods for proximal lesions.

Because DM directly alters the oral fluid environment, salivary and glycemic markers add disease-specific value. Diabetic patients show significantly lower salivary flow and more acidic pH than non-diabetic controls (Figure 2), and HbA1c testing links caries risk to the degree of glycemic control rather than to the diagnosis of DM alone. Table 1 summarizes the reviewed methods.

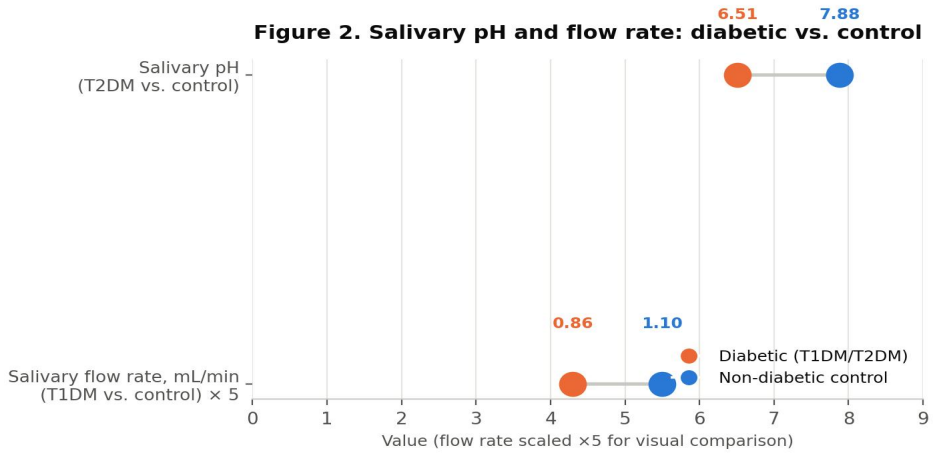


Figure 2. Salivary pH and flow rate in diabetic vs. non-diabetic patients.

Method	Reported performance	Relevance in diabetes
DMFT/DMFS, ICDAS	Standard clinical indices; ICDAS grades severity on a 0–6 continuum	Baseline caries-experience comparison; does not capture activity
DIAGNOdent (laser fluorescence)	Sensitivity 0.60–0.88; more false positives than visual exam	Adjunct for root/proximal lesions in periodontally involved patients

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Method	Reported performance	Relevance in diabetes
QLF/QLF-D	Sensitivity 0.62–0.91; outperforms radiography and DIAGNOdent for proximal caries	Detects subsurface lesions before cavitation
Bitewing radiography	Sensitivity 0.15–0.83; reference standard	Validates optical devices; limited by radiation exposure
Salivary flow rate & pH	T2DM: pH 6.51 vs. 7.88 in controls; reduced flow (0.86 vs. 1.10 mL/min)	Reflects hyposalivation and acidification driving caries risk
HbA1c	Confirms glycemic status/control	Links caries risk to metabolic control rather than DM diagnosis alone

Table 1. Summary of diagnostic methods for dental caries in patients with diabetes mellitus.

Figure 3 proposes an integrated pathway combining clinical, optical, and laboratory methods into a single risk- and activity-based diagnostic process.

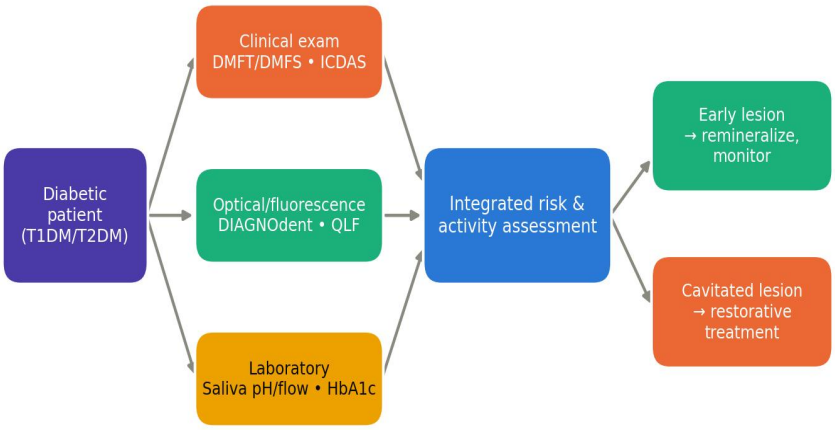


Figure 3. Integrated diagnostic pathway for dental caries in diabetic patients

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DISCUSSION

No single method is sufficient for diabetic patients: visual-tactile indices document caries experience but not activity or the underlying salivary/metabolic disturbances; fluorescence-based devices detect subsurface lesions but need combination with visual criteria to limit false positives; and salivary/HbA1c markers uniquely capture the mechanisms — hyposalivation, acidification, glycemic variability — that plausibly explain the inconsistent DM–caries findings in the literature.

This layered view also helps explain a recurring puzzle in the epidemiological literature: some studies report elevated DMFT/DMFS scores in diabetic patients while others find no significant difference from non-diabetic controls. If caries risk in DM were driven purely by the diagnosis itself, this inconsistency would be difficult to explain. Instead, the evidence reviewed here suggests that the

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effect is mediated by disease duration and glycemic control — factors captured by salivary and HbA1c testing but invisible to a DMFT or ICDAS score taken in isolation. This is precisely why a diagnostic protocol built only on clinical indices risks under- or over-estimating true caries risk in individual diabetic patients.

The comparative accuracy data in Figure 1 further indicate that the choice of adjunct method matters: QLF's advantage over DIAGNOdent for proximal lesions suggests it may be the preferable optical adjunct where equipment allows, while DIAGNOdent's established root-surface cut-offs (20–35) make it particularly useful for the root and furcation lesions more common in periodontally compromised diabetic patients. A practical protocol should therefore combine ICDAS-based examination as the primary method, a fluorescence adjunct selected according to the surface at risk, and salivary/HbA1c assessment for individualized risk stratification rather than a uniform DM label.

Limitations: as a narrative rather than systematic review, this synthesis draws on heterogeneous study populations (type 1 vs. type 2 DM, children vs. adults) and diagnostic thresholds, which limits direct pooling of the reported figures and should be kept in mind when applying them to a specific clinical setting.

CONCLUSION

Modern caries diagnosis in diabetic patients should integrate clinical indices, fluorescence-based optical devices, and salivary/glycemic markers rather than relying on visual examination alone. This combined approach, summarized in Table 1 and Figure 3, offers more accurate and earlier detection and should inform both clinical practice and future research in this population.

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