Clinical examination alone detects more secondary caries on crowned teeth than radiograph alone

**Original Article**

**Level of Evidence**
4

**Purpose**
The performance of clinical examination and radiographs in detecting interproximal caries was compared for crowned and uncrowned teeth

**Source of Funding**
Information not available

**Type of Study/Design**
Cross-sectional

**SUBJECTS**
The subjects were 100 patients with fixed prostheses who exhibited at least 1 secondary caries lesion. These subjects provided 820 teeth with crowns (365 single crowns, 455 fixed partial denture abutments) and 512 teeth with no restorations for the analyses.

**EXPOSURE**
Both interproximal surfaces of each crowned and unrestored tooth were evaluated clinically and by radiographs for the presence of caries. The clinical examination included use of an explorer.

**MAIN OUTCOME MEASURE**
Presence of caries (clinical levels: initial caries, caries suspicion, early caries, deep caries; radiographic levels: radiolucency limited to outer half of enamel, extending into inner half, reaching outer half of dentin, into inner half of dentin).

**MAIN RESULTS**
Clinical examination detected more caries lesions (11.2%) on interproximal surfaces of crowned teeth than did radiographic examination (8.3%), a difference that was statistically significant at P < .05%. Conversely, radiographs detected slightly more lesions on interproximal surfaces of nonrestored teeth (4.1%) than did clinical examination (3.3%). This difference was also statistically significant (P < .05).
Commentary

CONCLUSIONS
The authors concluded that “radiographs improved the diagnostic sensitivity for interproximal caries diagnoses for non-restored teeth and clinical examination was more reliable than the radiographic evaluation in the diagnosis of secondary caries in crowned teeth.”

ANALYSIS:
This report should not influence a practitioner’s approach to detection of secondary caries on interproximal surfaces of crowned or noncrowned teeth, assuming that the practitioner currently uses a combination of clinical and radiographic assessment. Although the report suggests that clinical examination is a more sensitive method of caries detection for crowned teeth, this finding could easily be a result of the design of the study rather than the superiority of the method. In short, the report is an excellent example of how not to design and analyze a comparison of 2 diagnostic methods. Three substantial threats to the internal validity of the study are evident:

• No diagnostic gold standard is employed. Each lesion detected by either method is assumed to be an accurate diagnosis. Because it is impossible to determine if the lesions detected by one method but not by the other are false positives or false negatives, the analyses presented in this article must assume that false positive diagnoses do not exist and that all differences between diagnostic methods represent lesions “missed” by one of the diagnostic methods. Although the problem is acknowledged in the discussion, it is not addressed in the analysis.

• Diagnostic certainty differs between diagnostic methods. In the comparison of diagnostic methods for crowned teeth, the clinical criteria include a “caries suspicion” option that is considered to be a positive caries diagnosis. But there is no such uncertainty option in the radiographic criteria. The greater frequency of caries detection (sensitivity) seen in this study when the clinical method is used may be explained simply by the fact that the clinical method acknowledges uncertainty, and considers it a positive diagnosis.

• The reliability of the measurements is not reported: the reliability of the single examiner in performing the clinical and radiographic examinations is not analyzed. This is important information for assessing the quality of the examinations.

Thus, the results of the study depend on 2 unproven assumptions: (1) that all diagnoses of caries represent caries lesions and (2) that the single examiner in the study was reliable. If either of these assumptions is not true, the results may not be valid.

Although the conclusion of the article states that the clinical method is more reliable than the radiographic method in crowned teeth, as noted, no reliability results were reported. The authors probably meant to state that in crowned teeth, clinical examinations were more sensitive. However, as noted, without a gold standard, even that conclusion is arguable.

The article makes no attempt to address the potential benefits of using a combined clinical and radiographic examination strategy. For example (and assuming for the moment that all caries diagnoses are valid), 122 of 1640 interproximal sites of crowned teeth were diagnosed as being carious by both clinical and radiographic examinations. An additional 62 surfaces were diagnosed as carious by the clinical exam alone, and 14 additional surfaces were diagnosed as carious by the radiographic exam alone. Although the clinical exam contributes 48 more unique diagnosed surfaces than the radiographic exam, the 14 surfaces contributed by the radiographic exam are also unique. Thus, relying solely on the clinical examination because of its superior sensitivity would mean missing 14 of 198 total lesions, about a 7% error rate.

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