Original Contributions

Influence of 2 caries-detecting devices on clinical decision making and lesion depth for suspicious occlusal lesions

A The National Dental Practice-Based Research Network randomized trial

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ABSTRACT

Background. A suspicious occlusal carious lesion (SOCL) can be defined as a lesion with no cavitation and no radiographic radiolucency but for which caries is suspected. The authors evaluated whether using a device changed the percentage of SOCLs that were opened surgically and, among those SOCLs that were opened, the proportion that had penetrated into dentin.

Methods. Eighty-two dentists participated. In phase 1 of the study, dentists identified approximately 20 SOCLs, obtained patient consent, and recorded information about the lesion, treatment or treatments, and depth, if opened. Dentists were then randomly assigned into 1 of 3 groups: no device, DIAGNOdent (KaVo), and Spectra (Air Techniques). In phase 2, dentists enrolled approximately 20 additional patients and recorded the same phase 1 information while using the assigned device to help make their treatment decisions. A mixed-model logistic regression was used to determine any differences after randomization in the proportion of lesions opened and, if opened, the proportion of lesions that penetrated into dentin.

Results. A total of 1,500 SOCLs were enrolled in each phase. No statistically significant difference was found in the change in proportion of lesions receiving invasive treatment from phase 1 to phase 2 across the 3 groups ($P = .33$) or in the change in proportion of percentage of opened lesions that extended into dentin ($P = .31$).

Conclusion. Caries-detecting devices in the study did not change substantially dentists' decisions to intervene or the accuracy of the intervention decision in predicting lesion penetration into dentin.

Practical Implications. The caries-detecting devices tested may not improve dentists' clinical decision making for SOCLs.

Key Words. Evidence-based dentistry; caries; dentin.

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Suspicious occlusal carious lesions (SOCLs) can be characterized as initial carious lesions on occlusal surfaces of posterior permanent teeth that have no cavitation and no radiographic evidence of caries, but the presence of a carious lesion is suspected because of roughness, surface opacities, or staining. Such lesions may be difficult to detect,[1-5] and they often present a diagnostic challenge because of the difficulty in determining whether the lesion has penetrated into dentin.[3,6,7] Not surprisingly, the lack of clarity about the presence and activity of caries associated with SOCLs leads to uncertainty among dentists over how to manage these lesions. A previous study conducted by The National Dental Practice-Based Research Network (the "network") found

the prevalence of these lesions was 34% and that almost one-half of the lesions on which practitioners performed invasive procedures did not penetrate clinically into the dentin.[8]

Dentists' uncertainty about the management of SOCLs was reflected in the introduction of and, anecdotally, the rapid adoption of caries detection devices. Many dentists are turning to these devices, hoping that they will provide more certainty; that is, that they will accurately identify the SOCLs when caries is present and has penetrated into the dentin. The most-recent systematic review of these devices, in 2013, concluded that there is only limited evidence to support their use as adjuncts to clinical decision making.[9] A systematic review of the most popular device found that its specificity in the detection of enamel lesions was low, meaning that many enamel lesions were incorrectly classified as penetrating the dentin.[10] Inadequate specificity can lead to false-positive results and unnecessary surgical intervention, which has continued to concern those who evaluated its performance.[11-13]

Previous studies of the performance of these devices were limited to assessing their performance (sensitivity, specificity, receiver operating characteristic analyses) in vitro and, less often, in vivo in an academic setting, which is not in a typical clinical practice setting. Outcomes obtained during their routine daily use by practicing dentists were never explored. Thus, the utility of a diagnostic device to improve the accuracy with which dentists detect caries and assess its degree of penetration is unknown. Furthermore, the extent to which the devices result in dentists making more-appropriate management decisions is equally unclear. Two of the more-popular caries-detecting devices are the DIAGNOdent (KaVo) (laser fluorescence technology) and Spectra (Air Techniques) (fluorescence technology that produces Doppler-like images). The purpose of our study was to evaluate whether using 1 of these devices changed the percentage of SOCLs that the dentist opened surgically and, among those SOCLs that the dentist opened, the proportion that had penetrated into dentin.

METHODS

We generated the results presented here as part of a larger study conducted in dental practices affiliated with the network. The network is a consortium of dental practices and dental organizations established to answer questions raised by dental practitioners in everyday clinical practice and to evaluate the effectiveness of strategies to prevent, manage, and treat oral diseases and conditions.[14,15] The network includes oral health care providers (general dentists, dental specialists, and hygienists).

Selection and recruitment process

Network practitioners were recruited by regional coordinators (RCs) through letters and announcements sent to licensed practitioners from the 6 participating regions (Western, Midwest, Southwest, South Central, South Atlantic, and Northeast). To be eligible for this study, practitioners had to complete an enrollment questionnaire, attend an orientation session or watch a video of it, and complete their training in protection of human individuals. The enrollment questionnaire, which is publicly available at http://nationaldentalpbrn.org/enrollment.php, collects information about practitioner, practice, and patient characteristics. Once practitioners completed the requirements, the RC provided a training session with the practitioner and staff that included an overview of the study and steps to complete the necessary forms and answered any questions they had related to the study. The network's applicable institutional review boards approved the study; all participants provided informed consent after receiving a full explanation of the procedures.

Study design

We divided this 3-arm randomized clinical trial into 2 phases. In phase 1, if a patient had an SOCL on a permanent molar, was 6 years or older, and consented (or, if a minor, assented, in conjunction with parental or guardian consent) to participate in the study, the practitioner completed data collection and patient characteristics forms. These forms included specific information about the patient and lesion. Lesion characteristics queried included luster (chalky or shiny), color (opaque, white spot, yellow/light brown, dark brown/black, or other), and roughness of the surface with the use of an explorer (did not use an explorer, yes roughness, or no roughness). Practitioners also documented the final treatment plan, which included monitoring, oral hygiene instruction, applying or prescribing fluoride, sealant (with no tooth structure altered), enameloplasty, preventive resin restoration, or full restoration. If practitioners indicated that they opened the lesion surgically, lesion depth and activity (no caries, inactive/arrested caries, active caries [E1], active caries [E2], active caries [D1], active caries [D2], active caries [D3]) were

ABBREVIATION KEY

PBRN: Practice-Based Research Network.
RC: Regional coordinator.
SOCL: Suspicious occlusal carious lesion.