

General dentists', pediatric dentists', and endodontists' diagnostic assessment and treatment strategies for deep carious lesions

A comparative analysis

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Dental caries is a worldwide public health crisis.¹ It is a chronic, diet-driven infectious disease² that if left untreated and allowed to progress could have serious negative consequences for oral and general health.^{3,4} Treatment of cavitated carious lesions is expensive, with costs directly related to the progressive nature of the disease process.⁵ To reduce costs and improve outcomes, it is crucial to understand

how carious lesions are diagnosed and treated.

Treatment of cavitated deep carious lesions

(DCLs) is part of routine daily practice for most dentists. Nevertheless, there is great variation across the dental profession regarding excavation depth and technique, as well as diagnostic criteria and aids for caries removal. Treatment may range from complete caries excavation with possible endodontic therapy to a less invasive excavation procedure, depending on which dentist provides the care. Although oral health care in many parts of the world has improved, with a marked decrease in caries activity among children and adolescents, data indicate that caries is still the most frequent reason for performing endodontic treatment.⁶ Thus, in 2016, an international group published recommendations on terminology and evidence-based practice guidelines for the management of DCLs.^{7,8} These recommendations should facilitate improved clinical decision making and enhance clinical success⁹ by helping standardize



Supplemental material is available online.

ABSTRACT

Background. There is a large variation among clinicians when managing deep carious lesions (DCLs). The purpose of this study was to assess general dentists' (GDs), pediatric dentists' (PDs), and endodontists' (EDs) diagnostic methods, clinical decision-making considerations, treatment strategies, and knowledge, behavior, and attitudes related to the diagnosis and treatment of DCLs.

Methods. A total of 175 GDs, 511 PDs, and 377 EDs responded to a nationwide Web-based survey.

Results. Most EDs (68%) and GDs (47%) practiced complete caries removal. PDs (31%) were more likely than GDs (12%) and EDs (4%) to remove carious tissues partially. Dentin hardness was the most important diagnostic criterion used during caries excavation (GDs, 90%; PDs, 72%; EDs, 88%). Only 30% of GDs, 17% of PDs, and 90% of EDs used diagnostic tests (for example, a cold test) when assessing pupal health. A substantial percentage of respondents considered endodontic treatment as a choice for treating DCLs in asymptomatic teeth in young patients (GDs, 40%; PDs, 30%; EDs, 40%). GDs rarely used a rubber dam when treating these lesions.

Conclusions. Most respondents practiced complete caries removal until hard dentin was felt, using hardness as the primary excavation criterion, and did not use pulp diagnostic tests routinely before making decisions about treatment of teeth with DCLs.

Practical Implications. Efforts should be made to translate the growing body of evidence supporting the use of conservative caries removal criteria to preserve pulpal health and tooth structure integrity when managing DCLs.

Key Words. Evidence-based dentistry; endodontics; pediatric dentistry; dentists; caries; carious lesions.

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treatment protocols on the basis of the best available evidence for the management of DCLs.^{6,10,11} However, to facilitate implementation of evidence-based guidelines, we first must understand what dentists are doing in practice and then determine which changes might be needed.

The number of studies on management of and decision making about DCLs is limited; for example, Oen and colleagues¹⁰ in the United States, Weber and colleagues¹² in Brazil, and Schwendicke and colleagues¹³ in Germany address this topic. No study investigators so far have compared the diagnostic approaches and decision-making considerations concerning the treatment of DCLs by general dentists (GDs), pediatric dentists (PDs), and endodontists (EDs). The objectives of this study were to assess GDs', PDs', and EDs' diagnostic methods, clinical decision-making considerations, treatment strategies, and knowledge, behavior, and attitudes related to the diagnosis and treatment of DCLs. The null hypothesis was that there would be no differences in the responses of the 3 groups of dentists and specialists concerning the use of diagnostic tests, conservative versus traditional approaches for caries removal, and the management of DCLs.

METHODS

This study was determined to be exempt from oversight by the Institutional Review Board for the Behavioral and Health Sciences at the University of Michigan, Ann Arbor, Michigan (HUM00095744; July 6, 2015).

Respondents. We conducted an a priori power analysis with a power analysis program (G*Power 3.1.3., <http://www.psych.uni-duesseldorf.de/abteilungen/aap/gpower3/>). The main focus was to explore whether the 3 groups of dental care providers differed in the frequencies of responses concerning whether they used certain diagnostic tools and treatments. To test such hypotheses, we used χ^2 tests for goodness of fit of contingency tables. We assumed a medium effect size of 0.30, an α error of .05, a power of 0.80, and 3 degrees of freedom. The results showed that a total sample size of 122 respondents was required for each group. To have 122 completed surveys for each group, we decided to collect data from 150 providers in each group because of the possibility of receiving incomplete surveys. Assuming a low response rate to a Web-based survey, we sent e-mails to 4,073 GDs, 5,410 PDs, and 4,100 EDs; we received sufficient numbers of responses from all 3 groups.

Procedure. We conducted a pilot study of the survey with 5 GDs, 5 PDs, and 5 EDs. On the basis of the results, we revised and finalized the survey. We then uploaded it to a Qualtrics (Provo, Utah) Web site. We bought the e-mail addresses of 4,073 GDs from 2 commercial companies because the American Dental Association does not share their members' e-mail addresses for research purposes. We purchased a list with 5,410 e-mail addresses

of PDs from the American Academy of Pediatric Dentistry, and we obtained 4,100 e-mail addresses of EDs from the 2015 membership directory of the American Association of Endodontists (AAE). Between October 2015 and January 2016, we sent a recruitment e-mail that explained the purpose of the study and included a Web link to the anonymous survey. Because the American Academy of Pediatric Dentistry does not permit follow-up e-mails, PDs received a single e-mail. However, starting in January 2016, GDs and EDs received 2 follow-up reminder e-mails 2 weeks apart.

Materials. The survey had 5 parts (see Supplemental Appendix, available online at the end of this article). Part 1 consisted of questions concerning the respondents' demographic, educational, and professional backgrounds. Part 2 concentrated on questions concerning the routine approach to the diagnosis of carious lesions, including questions about sensitivity tests, radiographs, and the use of patients' history. Part 3 presented the respondents with 3 different clinical scenarios that Weber and colleagues¹² originally developed and used. Each case included 3 images (that is, a clinical occlusal view, a periapical radiograph, and a clinical occlusal view after opening the lesion) plus information about the patient's age, general and dental history, oral hygiene practices, and the reasons for the consultation and clinical radiographic examination; see Figure 1 for an overview of the information provided. For each case, we first asked the respondents to choose the most likely diagnosis (including a mix of carious lesion and pulp status options, with multiple responses accepted) and then which treatment would be indicated. Part 4 consisted of questions concerning routine approaches to treating DCLs; Schwendicke and colleagues¹³ originally developed these questions. Finally, part 5 contained questions concerning the respondents' reasons for their treatment preferences and knowledge-related attitudinal items; Schwendicke and colleagues¹³ and Stangvaltaite and colleagues¹⁴ originally had developed these questions.

Statistical analyses. We imported the data from the Qualtrics website into a software program (SPSS Statistics for Windows, Version 22.0, IBM). We computed descriptive statistics such as frequency distributions and percentages to provide an overview of the responses. We used χ^2 tests to compare the frequencies of responses of the 3 groups of respondents; we accepted $P < .05$ as indicating the level of significance.

RESULTS

Part 1 of the survey. We collected data from 1,063 respondents of whom 175 were GDs, 511 were PDs, and 377

ABBREVIATION KEY. AAE: American Association of Endodontists. DCL: Deep carious lesion. ED: Endodontist. EPT: Electric pulp test. GD: General dentist. PD: Pediatric dentist.

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