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Sealants and dental caries:

Insight into dentists' behaviors regarding implementation of clinical practice recommendations

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Abstract

Background—The authors conducted a qualitative study of private-practice dentists in their offices by using vignette-based interviews to assess barriers to the use of evidence-based clinical recommendations in the treatment of noncavitated carious lesions.

Methods—The authors recruited 22 dentists as a convenience sample and presented them with two patient vignettes involving noncavitated carious lesions. Interviewers asked participants to articulate their thought processes as they described treatment recommendations. Participants compared their treatment plans with the American Dental Association's recommendations for sealing noncavitated carious lesions, and they described barriers to implementing these recommendations in their practices. The authors recorded and transcribed the sessions for accuracy and themes.

Results—Personal clinical experience emerged as the determining factor in dentists' treatment decisions regarding noncavitated carious lesions. Additional factors were lack of reimbursement and mistrust of the recommendations. The authors found that knowledge of the recommendations did not lead to their adoption when the recommendation was incongruent with the dentist's personal experience.

Conclusions—The authors found that ingrained practice behavior based on personal clinical experience that differed substantially from evidence-based recommendations resulted in a rejection of these recommendations.

Practical Implications—Attempts to improve the adoption of evidence-based practice must involve more than simple dissemination of information to achieve a balance between personal clinical experience and scientific evidence.

Keywords

Early carious lesions; evidence-based recommendations; pit-and-fissure sealants

The topic of evidence-based (EB) dentistry has been in the spotlight with regard to the American Dental Association's (ADA) clinical recommendations¹ for the use of pit-and-fissure sealants in the treatment of noncavitated carious lesions. Tellez and colleagues² conducted a study, the results of which showed that less than 40 percent of practicing dentists surveyed followed the ADA's recommendations to seal noncavitated carious lesions in children, adolescents and adults.¹ The study elicited a strong reaction from readers of *The Journal of the American Dental Association*.^{3,4} In a guest editorial in *JADA*, Niederman and colleagues⁵ pointed to the article by Tellez and colleagues² as a "troubling" example of dentists' rejection or slow adoption of current best evidence relevant to everyday practice. At issue is the complexity of balancing the best available scientific evidence with the dentist's clinical expertise and the patient's treatment needs and preferences—the ADA's definition of providing EB dentistry.⁶

Implementation of EB practice is believed to be critical to improving the quality of patient care,⁷ yet adoption has been slow. Investigators have described barriers to implementing EB practice⁷⁻⁹; however, little progress has been made in overcoming them. Researchers in most studies targeting identification of such barriers concluded that further research is needed to identify solutions to bridge the gap between evidence and practice.^{8,9}

In a systematic review of the literature, Cabana and colleagues⁷ identified a number of barriers to the widespread adoption of clinical recommendations among physicians, and they classified them into three main categories: knowledge (lack of awareness of or familiarity with the guidelines); attitudes (lack of agreement with guidelines or with outcome expectations, complacency regarding previous practice or a belief that they could not comply with the recommended guidelines); and behaviors (related to patient factors, the presence of contradictory guidelines or environmental factors such as lack of time, resources or reimbursement). The McDonnell Norms Group, an organization that looks at behavioral, cognitive and social factors influencing the application of knowledge for the public good, cited an additional barrier: failure of those generating guidelines to make them available to clinicians at the point of care.⁸ Research pertaining to the last barrier will provide investigators with an opportunity to better understand the behavior of practicing dentists with regard to their decisions to apply clinical recommendations to patient care.

Because most of the literature to date involves surveys and questionnaires, we decided to use a qualitative approach to observe dentists as they planned treatment for patients in simulated but realistic case scenarios in their own practice environments.

METHODS

We conducted this study to identify the behaviors and thought processes of practicing dentists when making treatment decisions regarding sealing of noncavitated carious lesions, as well as to inform future research into solutions to promote adoption of EB clinical

recommendations. We used a qualitative approach through the use of vignette-based interviews with dental practitioners in their practice environments. Investigators have used vignette-based interviews successfully to determine work roles, tasks and information-seeking behavior of dentists,¹⁰ and research findings have shown that people exhibit the same behavior that they would exhibit when faced with real-life information needs.¹¹ For example, a dentist who looks at a photograph of a tooth with caries likely would ask for radiographic findings; likewise, the dentist would want to obtain radiographs if he or she detected a carious lesion in a patient's tooth. We used an approach that included principles from "Thinking About Answers"¹² to encourage participants to "think aloud" as they reviewed the vignettes and determined their treatment plans. In the typical think-aloud process, participants are informed that the researcher is interested in their answers to questions, as well as the approach they used to determine those answers.¹²

We obtained informed consent from all participants. The institutional review board at the University of Pittsburgh (PRO11050612) approved this study.

Four full-time faculty members from the School of Dental Medicine, University of Pittsburgh (one pediatric dentist [A.M.], one general dentist [M.O.], one psychologist [D.E.P.] and one dental informatician [H.S.]) developed two case vignettes apropos of management for noncavitated carious lesions. The cases contained information regarding patients' medical, social and dental histories; dietary and oral hygiene habits; fluoride use; chief complaint; clinical and radiographic examination findings; and intraoral and extraoral photographs. On the basis of the ADA recommendations¹ for patients with the risk factors stated in the vignettes, the faculty members developed an optimal treatment plan for early caries management in both cases. Case 1 (Appendix A in the supplemental data to this article [found at <http://jada.ada.org/content/144/4/e24/suppl/DC1>]^{1,13}) describes a patient who was at low risk of developing caries, and case 2 (Appendix B in the supplemental data to this article [found at <http://jada.ada.org/content/144/4/e24/suppl/DC1>]¹³) describes a patient who was at a higher risk of developing caries owing to her history of caries in the previous 36 months.

We pilot tested the cases with part-time faculty members at the School of Dental Medicine who also provide care in private practice settings. Their feedback resulted in minor revisions to the introduction of the study and to the sequence in which we presented the cases and ideal treatment plans.

We recruited a convenience sample of 22 general dentists in private practice (Table 1). The project director (B.V.) interviewed the participants by telephone to obtain demographic data and to schedule an appointment at their practice location. After providing an initial orientation to the study, she presented the case 1 vignette to each dentist. The interviewer then asked each participant to develop a treatment plan on the basis of the information presented in the vignette and to explain orally what he or she was thinking and his or her rationale for treatment decisions. We repeated this process for the case 2 vignette.

The interviewer then presented the treatment plans developed by the four investigators, which were based on the ADA recommendations. The interviewer encouraged participants to express their thoughts about the recommendations and to articulate barriers to implementing them in their practices. The interviewer summarized the dentist's responses at the end of each interview to allow him or her to correct any misinterpretations. We transcribed audio recordings of the interview sessions, and two of us (J.A.O., B.V.) listened to them independently to identify themes.

We calculated Spearman rank correlation coefficient (ρ) to determine whether a relationship existed between years since graduation from dental school and treatment selected. We

ranked years since graduation from fewest to greatest. We ranked the selected treatment from 1 to 4, as follows: sealants, 1; monitoring, 2; fissurotomy with restoration, 3; and conventional restoration, 4. We obtained a value for ρ for each tooth and for the teeth in each case, and we aggregated them to include all teeth across both cases. We calculated an aggregate coefficient owing to the small sample size and the definition of all lesions in the study as being noncavitated.

RESULTS

The preliminary telephone interview with the 22 participants indicated that most were in solo practice and had graduated from dental school between 1965 and 2004. Slightly more than one-half were male, and participants' ages ranged from 25 years to older than 65 years. Twenty-seven percent reported that they were ADA members (Table 1).

As part of the so-called thinking-aloud process, participants orally summarized the information provided in each case and then articulated their decisions regarding treatment plans. Table 2 shows the treatment plans according to the case, as recommended by the participants. Because responses pertaining to the use of sealants for the treatment of noncavitated carious lesions did not differ substantially between the two cases (analyses not shown), we report the following results without reference to the specific case or tooth number.

All teeth in the two cases were described as having noncavitated lesions, which we defined for participants as a demineralized lesion without evidence of cavitation, also sometimes referred to as an early lesion, an incipient lesion, or a white-spot lesion.¹³ We also informed participants that radiographs obtained at the dental visit revealed no evidence of occlusal or interproximal lesions.

The treatment plans proposed by the four faculty members, which are based on the ADA clinical recommendations, consisted of monitoring or sealing the three teeth (nos. 3, 12 and 17) in case 1 and sealing teeth nos. 14 and 31 in case 2.

Of the 22 participants, only one recommended sealing the lesions without some operative intervention, such as a fissurotomy. The remaining participants recommended monitoring the teeth or placing a restoration; most reported that they were not aware of the ADA recommendations. We found a moderate positive relationship between years since graduation and choice of treatment for all teeth combined, as well as for case 1. Using Spearman rank correlation coefficient, we found a slight positive relationship for case 2 (Table 3). The correlation suggests a tendency by participants to choose restoration for the treatment plan the longer the time since graduation from dental school.

Participants' thought processes during treatment planning and after being presented with the ADA recommendations provide insight into the barriers to adoption of recommendations regarding sealant placement, as well as the behaviors that might be beneficial in developing solutions to these barriers. For example, because the practice behavior of peers may influence some dentists to accept new treatment approaches, peer groups might be an important audience to target when exploring ways to increase adoption of EB treatment.

The so-called think-aloud process revealed that participants considered all aspects of the patient's history before determining his or her risk status to guide treatment decisions. One participant provided a typical risk assessment summary:

He's not a routine dental patient. He hasn't been to a dentist in 31/2 years. He has [insurance] coverage because he works in a fast food restaurant while going to

school, which means he may not keep that job and he may not have coverage for another three years, so I look at that and think maybe we should do this because he might disappear for another three years. On the other hand, he eats a healthy diet, has good oral hygiene and doesn't have a caries history. I look at all this and think he's probably safe.

Caries diagnosis

Discussion of clinical findings between the interviewer and the participant provided some evidence regarding the dentists' approaches to caries diagnosis. Almost one-half of the participants indicated that their decision would be based on the presence or absence of a "sticking" of a sharp explorer in a suspicious lesion, despite having been informed that the lesions were noncavitated. In addition, there appeared to be some confusion regarding the term "noncavitated." Although evidence suggests that explorers are not necessary to detect early lesions,¹⁴ participants indicated that their final treatment plan would depend on use of an explorer, as illustrated in the following remarks:

- "I need [to use] an explorer. I bet that [the lesions] would both stick, and that would be my determination [regarding] occlusal [restorations] on those [teeth]. If I'm not able to probe a hole in the tooth, then I would probably check [it] in six months, and I think a lot of times something like this will evolve in six months."
- "I would use an explorer. Since they said the teeth are noncavitated, I assume you used an explorer because you couldn't come up with that [diagnosis] by just looking at the teeth."

Major themes

When the interviewer presented the ADA clinical recommendations to the dentists, three major themes emerged that provide some insight into why dentists are not using sealants to treat noncavitated carious lesions. These are a firm belief in clinical experience, which has shown that caries will progress under sealants; a concern that sealants do not last; and the lack of third-party reimbursement for sealants in adults. Participants expressed concern about the technique-sensitive nature of sealant placement and the inability to replace sealants in patients lost to follow-up. Several participants who said they were interested in presenting sealants as an option to their patients indicated their frustration with knowing that their patients likely would opt for no treatment or a restoration owing to the cost. The following are some of their responses:

- "Let me tell you why I don't pick sealants even though evidence says to seal. From my clinical experience, I know [that] getting that sealant to stay without a fissurotomy doesn't work well."
- "It's noncavitated but there [are] bacteria in there, and I know clinically that decay will still form under a sealant."
- [The patient] is beyond the age range and the biggest issue is that insurance will not cover the sealants and that matters to patients."

Two other themes emerged that involved a lack of awareness and misunderstanding of the ADA recommendations, as illustrated by the following comments:

- "I get letters from the ADA, I'm part of the [Academy of General Dentistry], I attend [continuing education] courses, but I'll be honest with you, I didn't know they were recommending placing a sealant on noncavitated lesions."

- “There is a lot of misinformation out there to sell something; it’s hard to discern. Any time I see a study, I always read who paid for the study, then I take it with a grain of salt.”
- “I think they base their guidelines on what works most of the time and not on an individual basis, and not long term, and it may not be cost-effective—all [of] those things.”

Possible solutions

When asked to talk about solutions that would help them implement EB practice recommendations regarding sealing of noncavitated carious lesions, 12 of the participants indicated that acceptance of the recommendations by their colleagues would have a moderate to high influence on their own behavior; all said that colleagues were an important source of information. Participants also indicated that more consistency in defining terms, better protocols for placing and maintaining sealants, increasing awareness of recommendations through continuing education courses, and insurance reimbursement would affect their adoption of the recommendations. For example, one participant said that “[m]ost of the information I rely on is through my study group, and I think [the group] has the greatest credibility as far as what I incorporate into my practice.”

DISCUSSION

Results of this study reflect those of Tellez and colleagues² in that participants generally had not adopted EB clinical recommendations regarding sealing of noncavitated carious lesions. However, the strength of this study is in providing insights into dentists’ decision-making processes with regard to implementing EB recommendations for patients at the point of care. The study findings were based on treatment plans provided by participants during presentation of simulated but realistic cases rather than on dentists’ self-reports of previous treatment administered in their practices. Gaining insight into the reasons behind certain practice behaviors may lead to more success in changing behavior than does simple dissemination of information, which has been shown to fail for the most part.¹⁵

Recommending sealing of noncavitated carious lesions depends on multiple factors, the first of which is an accurate assessment and diagnosis of the patient’s condition. In this study, each participant assessed historical findings (such as the patient’s dietary history, oral hygiene, frequency of dental visits) to arrive at a determination of risk status, which he or she used to guide treatment decisions. This is a positive and important step in the process of identifying sealants as an option for appropriate at-risk patients. However, nearly one-half of the participants recommended use of an explorer to make a diagnosis, and several expressed confusion regarding the terms “noncavitated” or “lesion.” Although we did not explore the reasons for this confusion during the study, the response of one participant may shed some light on the issue. This participant, who had been in practice for 35 years, stated that “[w]hen you start calling these ‘lesions,’ to me that’s a cavity and you have to fill a cavity.”

Teaching dental students how to identify and manage early noncavitated lesions conservatively is a rather recent addition to the curriculum in U.S. dental schools,^{9,16} and all but four participants in this study graduated before 2000. This may have implications for practitioners and for dental school curricula, because sealing noncavitated carious lesions cannot be part of a treatment plan if the dentist does not make an accurate diagnosis or if terminology is unclear.

Years since dental school graduation

Our study findings showed a possible correlation between years since graduation and the tendency to choose certain treatment options (Table 3). However, the sample size in this pilot study was too small to conclude that this may represent a shift toward younger dentists choosing more conservative treatment, but if such a trend is occurring, it may assist in identifying initial target populations for EB solutions in private practice. Researchers in future studies that are conducted on a larger scale could confirm whether such a trend exists.

Clinical experience

The most commonly occurring theme in this study was that clinical experience carried more weight than did scientific evidence in treatment decisions. Most participants reported that their clinical experience showed that sealants did not last and did not prevent caries from progressing. When asked if they would consider placing sealants after being shown the ADA recommendations, 15 participants (68 percent) said “no,” a finding in line with the results of a study in which investigators found that knowledge alone was insufficient to create changes in practice behavior.¹⁵ In addition, the technique-sensitive nature of sealant placement affects outcomes attributed to clinical experience (that is, the success or failure of the sealant procedure) and may need to be addressed as part of any effort to effect behavioral change if sealing of noncavitated carious lesions is to become accepted practice.

Lack of reimbursement

The lack of thirdparty reimbursement for sealants in adolescents older than 16 years and in the adult population was perceived by dentists in this study as a serious barrier. Until reimbursement becomes aligned with evidence, this barrier will be difficult to overcome. Also, it is unlikely that practitioners will attempt to convince patients that sealing noncavitated carious lesions is worth the out-of-pocket cost while they themselves are skeptical of the recommendations. Although any reimbursement amount by third-party payers likely will remain less than that for an occlusal restoration, the financial barrier to sealant placement will be lessened and may provide an incentive to place sealants rather than simply monitor lesions.

Increasing patients' awareness

Because patients' needs and preferences are an important component in providing EB care, increasing patients' awareness of treatment options that include sealants and engaging them in the decision-making process also may help shift treatment toward sealants. This will be the second phase of our research project, which involves increasing awareness of the recommendations for sealants among patients in the dental office, with the goal of determining if this can effect behavioral change in dental practices.

Participants in this study provided a glimpse into approaches that may prove to be more effective than simply making recommendations available, such as capitalizing on the strong peer influence in the dental culture. Investigators have suggested that this needs to begin with dental school education, and steps in this direction already are in motion, with accreditation standards that require teaching of EB care.¹⁷ Eventually, this should result in a critical mass of science-based practitioners; however, these practitioners also will be influenced by their more senior role models in the private practice arena, many of whom also teach part time in dental schools (and who might not advocate sealant placement). This strong peer influence points to the need for solutions that target barriers to EB care in the private practice setting so that EB practice can be reinforced in the dental education environment and transitioned seamlessly to private practice.

Study limitations

In this study we used a qualitative approach that involved a relatively small convenience sample of dentists, and the results are not generalizable to a larger population. Researchers in future studies can use participants' responses from this pilot study to develop valid instruments such as questionnaires and surveys for a larger sample. The results of this exploratory study can shape the design of future studies and allow for analysis of a statistically relevant sample.

The cases presented were those of two adult patients, and participants may have been less likely to consider sealants as an option for this patient population. Sealing noncavitated carious lesions may be one of the more controversial recommendations and an example of evidence that deviates more substantially from current clinical practice behavior than do other EB recommendations.

The order in which we presented the cases to participants remained the same for consistency, but it is possible that this order could have affected participants' responses. Investigators in future studies should consider an alternating or random order of presentation to address this possible effect. Involving patients in treatment decisions was not possible in this study design but, as mentioned earlier, will be part of the second phase of this project.

CONCLUSIONS

In this pilot study, we found that participants, for the most part, had not adopted EB recommendations pertaining to sealing of noncavitated carious lesions in adults. We are faced with the challenge of overcoming long-standing beliefs based primarily on personal clinical observations that seem to contradict scientific evidence. We need to avoid the fallacy of attempting to initiate behavioral change simply by providing information to health care professionals. Instead, we need to look for alternative ways to promote acceptance of EB recommendations. Findings from the social psychology literature, such as identifying factors that predict clinical behavior and that may be susceptible to change, may provide a novel approach to modifying dentists' behavior.^{15,18}

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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ABBREVIATION KEY

ADA	American Dental Association
EB	Evidence-based

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TABLE 1

Demographics of general dentists (N = 22).

VARIABLE	NO. (%) OF DENTISTS
Type of Practice	
Solo	17 (77)
Group	5 (23)
Sex	
Male	13 (59)
Female	9 (41)
Age, in Years	
25-34	2 (9)
35-44	6 (27)
45-54	10 (45)
55-64	3 (14)
65	1 (5)
American Dental Association Member	
Yes	6 (27)
No	16 (73)
Year of Graduation	
1965-1969	1 (5)
1970-1979	2 (9)
1980-1989	4 (18)
1990-1999	11 (50)
2000-2004	4 (18)

TABLE 2

Dentists' treatment plan recommendations, according to case and tooth number.

TREATMENT PLAN RECOMMENDATION	NO. (%) OF PARTICIPANTS (N = 22)				
	Case 1*			Case 2†	
	Tooth no. 3 (noncavitated pit-and-fissure lesion)	Tooth no. 12 (noncavitated pit-and-fissure lesion)	Tooth no. 17 (white, opaque noncavitated lesion)	Tooth no. 14 (small, noncavitated occlusal lesion)	Tooth no. 31 (noncavitated, chalky white opaque lesion along pits and fissures)
Place Conventional Occlusal Composite or Amalgam Restoration	4 (18)	7 (32)	4 (18)	3 (14)	10 (45)
Open the Fissure and Place a Small Resin/Sealant Restoration	7 (32)	6 (27)	4 (18)	4 (18)	4 (18)
Reexamine Lesion at Next Recall Visit	10 (45)	8 (36)	14 (64)	15 (68)	7 (32)
Seal Lesion and Follow Up During Regular Checkups	1 (5)	1 (5)	0	0	1 (5)
TOTAL	22 (100)	22 (100)	22 (100)	22 (100)	22 (100)

* A full-mouth series of radiographs was obtained at the dental visit and there were no occlusal or interproximal lesions.

† Radiographs were obtained at the dental visit, and there were no occlusal or interproximal lesions.

TABLE 3

Spearman rank correlation coefficient between years since dental school graduation and choice of treatment.

CASE	SPEARMAN RANK CORRELATION COEFFICIENT (TOOTH NO.)			
	Case 1	0.44 (3)	0.52 (12)	0.44 (17)
Case 2	0.31 (14)	0.31 (31)	— *	0.29 (Combined)
Cases 1 and 2 Combined	0.48			

* Not applicable.