Evidence-based dentistry in clinical practice

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ABSTRACT

Background. Evidence-based dentistry, or EBD, is not a new concept for the dental profession in the United States. The American Dental Association has long relied on credible scientific evidence in setting policy and communicating with dentists and the general public. EBD provides an approach to oral health care that follows a process of systematically collecting and analyzing scientific evidence to answer a specific clinical question.

Overview. The authors discuss applications of systematic review findings to everyday clinical practice and explore the implications of EBD for dental education, clinical research and the provision of care to patients.

Conclusions and Practice Implications. In developing appropriate treatment plans, dentists should combine the patient's treatment needs and preferences with the best available scientific evidence, in conjunction with the dentist's clinical expertise. To keep pace with other health professions in building a strong evidence-based foundation, dentistry will require significant investments in clinical research and education to evaluate the best currently available evidence in dentistry and to identify new information needed to help dentists provide optimal care to patients.

During the 1990s, a new process for reviewing scientific evidence emerged in medicine and other health fields. It takes a systematic approach to summarize the large volume of literature that health care providers need to assimilate into their practices. Given the impossibility of reading the many articles published each year, the evidence-based medicine, or EBM, process uses a systematic approach to review and publish the evidence relevant to specific clinical situations. Through the dissemination of such evidence, the EBM process is designed to help practitioners provide the best care to patients. Building on the systematic reviews available in dentistry, we discuss how the findings of such reviews can be applied in everyday clinical practice.

Evidence-based dentistry provides an approach to oral health care that follows a process of systematically collecting and analyzing scientific evidence.

Applying EBM principles to dentistry, the American Dental Association developed the following definition for the term "evidence-based dentistry," or EBD: "an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient's oral and medical condition and history, with the dentist's clinical expertise and the patient's treatment needs and preferences."[1]

This definition clearly identifies three domains for the provision of evidence-based dental care; namely, incorporation of the best scientific evidence with dentists' clinical expertise and patients' preferences. We will address each of these domains in regard to applications of systematic review findings for clinical decision making.

IDENTIFYING BEST EVIDENCE

The emphasis on assessing the strength of the evidence for any given question increased substantially in the 1990s, as it grew increasingly obvious that single studies were insufficient to answer such questions. Replication is the basis for scientific discovery. In medicine, expert opinions and even information based on case studies are

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not considered to be sufficiently strong or credible evidence in the decision-making process. Rather, the collective knowledge gleaned from reviewing all studies relevant to a clinical question should form the basis for clinical decisions. The quest in health care is, and will continue to be, to provide the best care. However, best care demands the best evidence, which is the least biased in terms of design, analysis or interpretation.

According to the ADA policy statement on EBD,[1] the term "best evidence" "refers to information obtained from randomized controlled clinical trials, nonrandomized controlled clinical trials, cohort studies, case-control studies, crossover studies, cross-sectional studies, case studies or, in the absence of scientific evidence, the consensus opinion of experts in the appropriate fields of research or clinical practice. The strength of the evidence follows the order of the studies or opinions listed above."

In this definition, the hierarchy of evidence for therapeutic interventions is listed in the order of the study's (or opinion's) vulnerability to bias, an inevitable factor in virtually every decision. However, randomized controlled clinical trials, if properly designed and conducted, can reduce or control the effect of bias on the findings better than can other study designs, such as case studies.

The dental profession must advance by identifying the new information needed to help dentists provide the best care for patients.

Using this new scientific standard, the dental profession must advance by evaluating the currently available best evidence and identifying the new information needed to help dentists provide the best care for patients. This systematic approach of carefully evaluating existing scientific evidence has emerged as the standard for health care professions in the United States and in other countries.

Although some have questioned the rationale for EBD and the opportunities associated with this approach,[2,3] it is clear that the evidence-based approach raises questions about how the dental knowledge base has been incorporated into dentistry, both in dental education and clinical practice. Presenting selective evidence in teaching and practice can lead to biased decisions, but if the methods of EBD are followed appropriately, there is less potential for bias by researchers, academicians and other experts.

This issue merits further consideration. The scientific knowledge base for dental practice has led to significant improvements in the oral health status of Americans (for example, reduction in the burden of dental caries, advances in treating periodontal diseases, new restorative materials, new diagnostic tests and dental implants). However, the translation of scientific information, particularly new findings in the basic and clinical sciences, into education and clinical practice has been slow.[4,5]

For example, caries diagnosis still is based on the use of an explorer, extraction of third molars remains widely advocated despite the weak evidence supporting universal removal of these teeth and some state dental board examinations permit restoration (rather than remineralization) of teeth with lesions that have penetrated no farther than the enamel. To a substantial extent, the slow translation of information from research to dental practice reflects the traditional ways in which dentists have acquired and used evidence when making decisions.[6]

MODELS FOR CLINICAL DECISION MAKING

Dentists have been trained to rely on knowledge gained from experience (both successes and failures) and to learn from colleagues when providing oral health care to patients. Most dental students are trained under the auspices of the so-called master teacher or clinician. Unfortunately, dental academicians have yet to develop a formula for training so-called master clinicians. As a result, dental students are taught by several inconsistent and sometimes contradictory teachers, and are trained to search for expert opinion and learn from the clinical experiences they encounter.

Although many dental schools have developed problem- or case-based learning programs, these programs focus largely on the didactic portion of the curriculum rather than on learning through the provision of dental care. Problem-based learning can ensure that evidence-based practice is followed when students and their tutors rely on quality systematic reviews of evidence or critical appraisal of relevant scientific studies. Hence, problem-based learning could provide a vehicle for promoting evidence-based decision making. Unfortunately, in our opinion, the translation of these experiences from the seminar room to the clinic still is limited.

Model 1. In this article, we present three models of professional decision making. Model 1, or the experiential model,[7] is dynamic and provides direct feedback (for example, the restoration resolved the patient's pain and, therefore, was the appropriate treatment). On the other hand, this model's major drawbacks include its minimal scrutiny of the biases of the master clinician or educator, and the absence of formal and independent mechanisms for considering clinical observations that do not agree with the master educator's opinions.

Model 2. A second approach to clinical learning and decision making builds on model 1 by adding one important element. In addition to relying on experiences and expert opinions, dentists adhering to model 2 search for the best clinical scientific studies that might provide information that can assist in resolving a clinical problem. Dentists who take this approach are expected to critically appraise the information provided in scientific studies and judge the validity of each study's conclusions.

We do not advocate the use of only one model in regard to clinical decision making or lifelong learning.

In dental schools, basic (laboratory-based) research often has received more emphasis than clinical research. However, the same scientific principles that drive basic research have been, and can be, applied to the resolution of clinical problems.[8] The essence of scientific inquiry is the control and measure of biases that may affect findings related to a clinical question. Hence, a clinician using model 2 should attempt to search for and critically appraise scientific studies that address the clinical question of interest. Unfortunately, most dental schools' clinical curricula do not reinforce the importance of learning to identify and critically appraise scientific evidence.

Model 2 may result in better decisions regarding clinical care and, most importantly, provide clinicians with opportunities for lifelong learning. However, a major drawback of this model is that it requires nearly constant searching for evidence, an unrealistic expectation for most dentists.

The recent appearance of two journals, Evidence-Based Dentistry and The Journal of Evidence-Based Dental Practice, is a major step forward. Both of these journals are devoted to critically appraising clinical studies and presenting information in a format that clinicians can use readily. Clinical scientific articles, not anecdotal reports or expert opinions, published in JADA or state dental journals also can facilitate decision making using model 2.

Although model 2 is a step toward practicing EBD, it is limited in that those who seek scientific evidence may be unable to identify all relevant studies to answer a clinical question. Searching for all available evidence is a time-consuming process that is fraught with difficulty because it requires expertise in searching databases of published studies.[9] Consequently, model 2 still may result in biased conclusions, because a clinician may find only some of the evidence or may select only the evidence that confirms his or her point of view, dismissing other studies that offer contrary viewpoints.

Model 3. To resolve these problems, the EBD process offers a third model. In this approach (model 3), the clinician locates and uses systematic reviews of all the evidence that addresses a specific clinical question. The ADA defines a systematic review as follows: "a process of systematically locating, appraising and synthesizing evidence from scientific studies in order to obtain a reliable overview. The aim is to ensure a review process that is comprehensive and unbiased. Findings from systematic reviews may be used for decision-making about research and the provision of health care."[1]

We should place emphasis on the word "locating" above because dentists, as well as other health care professionals, have neither the time nor the resources to conduct systematic reviews. Accordingly, practitioners who follow model 3 rely on systematic reviews conducted by teams of clinicians and methodologists. The disadvantage of model 3 is that the systematic reviews require expertise and time, and are currently limited in the scope of clinical questions they address.[9]

We do not advocate the use of only one model in regard to clinical decision making or lifelong learning. However, model 1 by itself is insufficient to ensure that dentists consistently provide the best care to the public. An evidence-based practitioner should follow model 2 if there is enough good-quality clinical evidence or, ideally, model 3 if a systematic review of the evidence is available.

EVIDENCE-BASED CLINICAL PRACTICE

Using three examples below, we illustrate how

dentists can use model 3 when making clinical decisions.

Ice cubes or chlorhexidine. A pediatric oncologist once asked a dentist for advice on the best method she could use to prevent oral mucositis in children with head and neck cancer who are receiving chemotherapy. The oncologist reported that her experience with chlorhexidine mouthrinse and antifungal medications had not been positive. Although symptomatic treatment had been the common method of managing this condition, the dentist wanted to determine what new evidence was available to address the prevention or treatment of oral mucositis.

The dentist decided to use PubMed, a publicly accessible database maintained by the National Library of Medicine ("www.ncbi.nlm.nih.gov/PubMed"). The dentist searched PubMed for "systematic review and mucositis," and found one systematic review[8] of 52 randomized controlled trials on the prevention or treatment of oral mucositis in patients undergoing chemotherapy or radiotherapy for cancer. The systematic review included six randomized clinical trials evaluating the efficacy of chlorhexidine, and two trials evaluating the efficacy of ice chips in preventing mucositis.

A meta-analysis is a review that uses quantitative methods to combine the statistical measures from two or more studies.

A meta-analysis (that is, a review that uses quantitative methods to combine the statistical measures from two or more studies and generates a weighted average of the effect of an intervention, degree of association between a risk factor and a disease, or the accuracy of a diagnostic test)[1] of the six clinical trials that evaluated chlorhexidine found that it was ineffective in preventing oral mucositis.[8] Furthermore, a systematic review of findings of the trials evaluating ice chips found moderate evidence that ice chips may be beneficial in preventing or reducing oral mucositis.[8]

The dentist believed that she had the current best evidence to offer the oncologist: while ice chips may not be the ideal solution to the problem, they seemed to provide an inexpensive, less intrusive and possibly effective method of preventing oral mucositis.

Effectiveness of fluoride varnish. A dentist working in a rural community wanted to know whether he could use a fluoride varnish to prevent dental caries in children. To address this question, he contacted a colleague working at a nearby dental school. Because fluoride varnishes are not widely used, the dental faculty member decided to search for evidence before responding.

The dental school library had access to the library of the Cochrane Collaboration, an international volunteer organization of experts in all fields of medicine, dentistry, nursing and other health fields. These experts work with methodologists and statisticians to conduct systematic reviews and publish them in an Internet-accessible database (or on compact disk). Using the online version of the Cochrane Collaboration library ("www.nelh.nhs.uk/cochrane.asp"), the dental faculty member searched for systematic reviews of clinical studies of "fluoride varnish" and found two such reviews: one on the efficacy of fluoride varnishes in the prevention of dental caries in children and adolescents,[10] and another that more broadly addressed topical fluoride therapy as a caries-preventive intervention for children and adolescents.[11]

The systematic review of topically applied fluoride varnishes by Marinho and colleagues[10] found nine randomized or quasi-randomized controlled trials with blind assessment of outcomes. In these trials, subjects in the control groups received either a placebo or no treatment for at least one year/school year. This review found that the overall preventive fraction (that is, the mean caries increment in the control group minus the mean caries increment in the treated group, divided by the mean caries increment in the control group) was 46 percent, suggesting that fluoride varnishes could significantly decrease the incidence of new carious lesions in children. The authors concluded that fluoride varnishes have substantial caries-inhibiting effects in both the permanent and primary dentitions.

Occlusal adjustment and temporomandibular disorders. An attorney contacted a state dental association seeking advice about a lawsuit filed by a patient against a dentist. The patient was diagnosed several years earlier as having a temporomandibular disorder, or TMD. She had been treated with painkillers and muscle relaxants. However, when she changed jobs and moved to a new city, the patient's new dentist told her that she needed occlusal adjustment to fix her bite, which was causing the pain in the facial muscles.

The patient's attorney wanted to know whether there was any credible scientific evidence showing that occlusal adjustment could relieve the facial pain that his client had experienced over the years. Searching the National Library of Medicine database through PubMed, a staff dentist at the state dental association found one systematic review of randomized controlled trials evaluating the impact of occlusal adjustments (occlusal splints and occlusal adjustment) on signs and symptoms of TMD.[12] The systematic review found four randomized clinical trials of poor quality, and thereby determined that the current evidence did not support the efficacy of occlusal adjustment in the treatment of TMD. Hence, this question remains unanswered, and further research is required before a definitive answer can be reached. The evidence does not support or refute the claims of the patient.

IMPLICATIONS OF EBD

Scientific evidence, when collected and analyzed systematically, can provide useful and current information to dental practitioners. However, scientific evidence by itself is insufficient for dentists to provide appropriate dental care. By necessity, dentists also should consider patients' circumstances and preferences regarding outcomes when recommending treatments.

The ADA definition of EBD, included within the Association's EBD policy statement,[1] is explicitly addresses the need to incorporate patients' characteristics in treatment planning, including their "treatment needs and preferences," social factors and the dentist's judgment of the patient's compliance level with recommended treatments. Expanding the scientific basis for clinical care also will increase patients' access to better information, and could significantly affect the choices they make regarding their oral health care.

In an evidence-based model of clinical practice, a patient's consent for treatment requires full disclosure of scientifically validated information. In instances in which the evidence is lacking or weak, patients should be so informed.[13] While EBD may seem to intrude on dentists' autonomy, the benefit of this practice model is that it protects dentists from legal liability by fully disclosing all information that has been critically reviewed by dentists and methodologists.

In the current information era, knowledge is both a tool and a commodity that can be used to improve the decisions made by dentists every day. Information summarized within systematic reviews should assist dentists in making appropriate treatment decisions with patients. EBD helps dentists by providing simple and validated scientific summaries. Personal experience, because of its potential for bias, should no longer be the sole source of lifelong learning in dentistry. Furthermore, the lack of consistency in treatment decisions among dental[6,14] and medical practices[15-17] is problematic. Shifting from a reliance on the experiential model of decision making to an evidence-based model would benefit all health care professions, as well as the general public.

A primary advantage of the evidence-based practice model is that it provides the least-biased, best-validated information on which to base decisions. However, the available scientific evidence for many aspects of clinical dentistry is either weak or nonexistent. This presents the dental profession with a major hurdle as it begins to implement an evidence-based model of clinical practice.

As the leading proponent of science-based oral health care, the American Dental Association is pursuing initiatives to promote clinical and translational research in dentistry. Through its activities, the ADA strives to provide appropriate information for dentists to use in daily practice, and to promote EBD as an approach to oral health care that aims to ensure that the ultimate applicability of a specific treatment modality is based on the best available scientific evidence and critical review of the literature.

CONCLUSION

In the evidence-based approach to clinical decision making, dentists incorporate the best scientific evidence—evidence that is critically appraised in systematic reviews—with clinical experience and their patients' preferences for treatment outcomes. The dental profession should define clinically relevant questions, commission systematic reviews to answer those questions and, when evidence is not available, advocate for good-quality clinical research to be conducted to provide the answers.

Findings from systematic reviews should be presented to dentists in formats that they can easily use in their daily practice. This article has provided examples of how EBD may be used in clinical practice and dental education. ■

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