GUEST EDITORIAL

Evidence-based Dentistry and the Dental Research Community

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The dental research community (academic and non-academic research and funding agencies) is supported by society principally in expectation that research findings will improve the public's oral health. Clinicians' incorporation of dental research findings into their care of individual patients is central to maximizing the benefit and reducing the harm of treatment (Clarkson *et al.*, 1999). Taxpayers' investment in dental research over the last 50 years has led to significant improvements in oral health status. Yet the success of dental research in answering clinically relevant questions related to diagnosis, risk assessment, and outcomes of dental care has so far been limited. For some of these areas, there is evidence that has not been transferred into practice, and for others the evidence is either lacking or of poor quality. Currently, a new approach for facilitating the process of defining a clinically relevant research agenda and translating research into practice is being advocated in the health-related disciplines. Evidence-based health care depends on forging effective links among producing the evidence, making the evidence available, and using the evidence. An evidence-based approach can directly affect the process for defining research priorities and how the results of dental research are translated into practice. Evidence-based dentistry (EBD), if endorsed by the dental profession, including the research community, may well influence the extent to which society values dental research. Hence, dental researchers should understand the precepts of EBD, and should also recognize the challenges it presents to the research community to strengthen the available evidence and improve the processes of summarizing the evidence and translating it into practice.

Key words: evidence-based dentistry, treatment outcomes, systematic review.

What is evidence-based dentistry?

Evidence-based dentistry incorporates the "conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (Sackett *et al.*, 1996). Hence, at the most basic level, EBD is comprised of two elements, one research-related and one practice-related. The research-related element is the synthesis of available evidence in the most objective way possible, such as a systematic review. Systematic reviews are "summaries of available scientific evidence in which studies are collected, evaluated, and synthesized in accordance with an organized, structured set of methods" (Woolf, 1996). Like original research projects, systematic reviews start with a hypothesis (or a question) that is answered through collection, appraisal, and analysis of published and unpublished research. The gold standard for evidence in a systematic review of effectiveness is the randomized controlled trial (RCT). Other sources of evidence, such as longitudinal studies, case-control studies, and cross-sectional studies, may be included in a systematic review, although the conclusions will be subject to additional threats to internal validity.

The methods for conducting systematic reviews are different from the approaches that dental educators and researchers currently follow in conducting reviews of the literature. Traditional reviews of the literature are conducted using expert opinion defining the questions and in selecting and summarizing the evidence. Systematic reviews are conducted by a collaborative team of experts in a clinical discipline and methodologists trained in searching, appraising, and summarizing all evidence, whether published or unpublished. The team defines a clinically focused question relevant to the provision of care. The team conducts a systematic search for all evidence that may help in answering the question (Mulrow, 1994). Formal and explicit methods are adopted, and inclusion and exclusion criteria for studies are defined. Appropriate statistical methods may then be used for pooling suitable quantitative data. This thorough and time-consuming approach results in better quality reviews of the evidence that are less subject to biases (Barnes and Bero, 1998; Jadad *et al.*, 1998).

The practice-related element in evidence-based dentistry is the clinician's integration of the resulting knowledge with

clinical expertise and patient preferences to determine the treatment to be recommended to individual patients. The practice of EBD requires the blending of research knowledge with provider experience. While, in theory, this blending occurs naturally as a result of individual clinicians' continued learning, examples of the failure of clinicians to incorporate current best evidence into their treatment decisions are plentiful, from the slow growth in the use of dental sealants (Anonymous, 1995) to the practice of removing asymptomatic third molars (Song *et al.*, 1997). EBD is an approach to make research findings more accessible to clinicians, and more clearly applicable to dental practice.

Current status of clinically relevant evidence in dentistry

The translation of research into practice assumes that clinically relevant evidence is available. Unfortunately, in light of the billions of dollars invested in dental research during the last five decades in Europe and the US, the dental research community has paid relatively little attention to clinical aspects of care. Consequently, and contrary to the situation in medicine, there are relatively few randomized controlled trials and other outcomes-oriented studies in dentistry that have evaluated clinically relevant interventions (Bader and Shugars, 1995). For example, there are no clinical trials that have compared the outcomes of different methods of caries diagnosis using relevant outcome measures. Also, no outcome studies are available for disease-based management of dental caries, periodontal diseases, or facial pain. Perceptions dominate aspects of the clinical decision process in dental care. For example, the question of prognosis of teeth adjacent to a single missing and unreplaced posterior tooth has never been examined (Shugars *et al.*, 1998). While expert opinion is available in a variety of texts that describes the phenomenon of arch collapse, expert opinion is generally not appropriate evidence (Sackett and Wennberg, 1997). Thus, while dental treatment is routinely recommended to replace single missing posterior teeth, the recommendation is essentially unsupported by evidence.

Long-term RCTs designed to evaluate dental treatment are rare, compared with short-term trials of dental materials, and preventive and periodontal treatment interventions. However, few short-term trials have been conducted on the most common preventive and treatments. Evidence from observational studies is available to address some outcomes questions, and while such study designs are often usable, they are less likely to lead to definitive conclusions (Sackett and Wennberg, 1997). Unfortunately for dentistry, even this type of evidence is scarce for many of the most frequent treatments. Where evidence is available, the range of outcomes used to evaluate treatment is usually limited to technical issues such as mechanical features and survival of teeth and restorations. The evidence needed for evidence-based dentistry must include a broader range of outcomes, including those considered important by patients. For example, a classic definition of appropriateness indicates that treatment is deemed appropriate when the expected health benefit exceeds the expected negative consequences by a sufficiently wide margin that the treatment is worth doing (Park *et al.*, 1986). The health benefit and the negative consequences referred to in this definition most certainly include important psychosocial and economic outcomes as well as more familiar clinical and biological outcomes.

How to build the evidence for evidence-based dentistry

The reasons for the lack of evidence about the effectiveness of dental care are many (Bader, 1992). In our opinion, the key reasons are the historical reluctance of international funding bodies to support research measuring clinically relevant outcomes; the "image" of this type of clinical research activity within the dental research community; the time constraints imposed by prospective outcomes studies; and the lack of trained researchers in this field. In addition, there is a dearth of reviewers who can reliably evaluate clinical research proposals and papers. Consequently, sound research proposals are rejected, and publication bias occurs when clinical research studies are not published. These barriers notwithstanding, the need for high-quality evidence is clear, and the dental research community will be expected to supply it in coming years.

To strengthen the evidence will require increased support for programs to develop, review, and conduct clinically relevant research projects. A review of the current output of research in this area in the US is sobering. For example, in fiscal year 1998, the National Institute of Dental and Craniofacial Research supported 18 projects with identifiable components addressing treatment outcomes, from a total portfolio of over 860 projects (NIDCR, 1998). The Agency for Health Care Policy and Research (AHCPR), with a smaller budget and portfolio, supported three such projects. In addition, there is a need for research into the methodological aspects of summarizing the information we have. This is an important issue for systematic reviews in dentistry because of the volume of evidence that comes from non-RCTs. Research on computer modeling to control for confounding and effect modification and methods for quality evaluations of non-RCTs should become a priority as the field of evidence-based dentistry develops. This should be a high priority for the international funding agencies sponsoring evidence-based health care, such as AHCPR.

The "image" of outcomes research will change if support increases and training opportunities become more available, and as the contributions of this type of research are recognized. However, the building blocks for such research must also be strengthened. Steps in this process include improving outcomes measures, developing and implementing diagnostic codes, and broadening practice-based research. For example, a valid and reliable measure of dental caries as assessed by practitioners is necessary if practice-based studies of caries-related outcomes are to be usable. Similarly, simple instruments to assess patient preferences and oral-health-related quality of life should be

developed. Diagnostic codes are a necessary addition to patient records, and to claims forms, if treatment outcomes are to be determined for specific clinical conditions, and in the light of pre-existing conditions. Cooperative agreements with individual practices and practice networks must be forged to begin collecting data necessary for effectiveness studies, and to provide the best evidence where RCTs are impossible or impractical.

Dental schools are important players in accomplishing these steps. Schools must recognize and allow for the episodic nature of outcomes research, which limits the pursuit of a "line" of related research questions supported by a single project. Schools can serve as sources for outcomes data by improving their administrative records systems, they can "partner" with managed care organizations interested in developing shared research activities, and they can encourage alumni to participate in research networks. Finally, schools can, and must, instill a healthy skepticism of empiricism and expert opinion in lieu of evidence among students and faculty.

Translation of evidence into practice

Processes to facilitate the translation of the evidence into practice also need to be improved. While EBD can provide clinicians with clear answers to questions about specific treatments, this information is intended to be used in conjunction with clinicians' expertise and specific patient factors. EBD is not intended to be "cookbook" dentistry, but it is envisioned as a disciplined process where the best objective information of the risks and benefits is weighted with clinical experience and patient preferences. However, most dentists in teaching institutions or clinical practice have not been prepared to deal with the conscious and conscientious integration of best evidence into clinical practice, and hence may be less than effective in adopting evidence-based practice. Strategies for training clinicians in adopting an evidence-based pattern of practice are urgently needed, since both the medical and dental literature suggest that traditional methods used to change clinical behavior, such as continuing education, are at best only partially effective (Bader, 1987; Davis *et al.*, 1995; Bero *et al.*, 1998).

Easy access to the best evidence is also necessary if EBD is to proceed. The Cochrane Collaboration emerged in response to demand for up-to-date reviews of all relevant RCTs in health care. The Cochrane library represents a formidable attempt to make such information accessible, and in medicine almost 500 reviews have been completed, with an additional 500 protocols registered (Cochrane Collaboration, 1999). In the US, the Agency for Health Care Policy and Research has funded 12 Evidence-Based Practice Centers, which are now reporting their first set of reviews. Dentistry is not quite so advanced, but signs of growth are beginning to emerge. The Cochrane Oral Health Group has seven registered protocols, and two completed reviews, and membership in this international voluntary group is increasing. The National Institute of Dental and Craniofacial Research has funded a dental evidence-based practice center as of July, 1999.

The impact of evidence-based dentistry on the dental research community

Evidence-based dentistry opens a new era in dental research. This movement can bring together traditional basic science researchers with clinical researchers, clinicians, and educators. The current barriers that exist between the dental research community and the practicing community can diminish as evidence-based teams start to work on finding, appraising, summarizing, and analyzing evidence to answer clinically relevant questions. The gaps they identify in the evidence will constitute arguments for designing and implementing both prospective and retrospective studies to answer critical clinical questions. Moreover, evidence-based dentistry represents a potential strengthening of the complex process of science transfer, of translating research into practice. Dental research has a vested interest in this movement, because research results are the raw input to the process. The success or failure of evidence-based dentistry will affect dental research's implied contract to improve the oral health of the public. The challenges for dental research are to establish an international dialogue and collaboration to strengthen the evidence and to improve the processes through which clinicians integrate it into their treatment decisions. There are clear paths to meet these challenges that require the cooperation of dental research, dental education, and international funding agencies.

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