Evidence-based Dentistry: Systematic Reviews

The practice of dentistry presents many challenges on a daily basis. Keeping up with new materials and techniques, dealing with the numerous demands of running a small business, and meeting a variety of professional obligations all compete for our time and attention. The greatest challenge, however, and the one dentists strive to meet to the highest degree, is the provision of quality oral health care in a skilled, compassionate and effective manner.

Clinical dentistry is becoming increasingly complex and our patients more knowledgeable. The Internet and the ready availability of health information have created consumers who demand the "latest" tests and treatments. Socio-demographic characteristics associated cultural customs and patient values are changing. Practitioners are overloaded with information, much of which is conflicting, inaccurate or unproven. The need for reliable information and the unprecedented ability to access it have come together to create a "paradigm shift" in the way health care is delivered.

This paper will examine the concept of evidence-based dentistry (EBD), including some of the barriers to and challenges of embracing this philosophy in practice, and will discuss how the "building blocks" of evidence-based care - systematic reviews and clinical practice guidelines - are used to integrate and summarize existing evidence for the use of practising dentists.

The Evidence-based Paradigm

Evidence-based care is a global movement in all the health science disciplines. It represents a philosophical shift in the approach to practice - a shift that emphasizes evidence over opinion and, at the same time, judgement over blind adherence to rules. This approach provides a bridge between research and everyday patient care.

Evidence-based practice is "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients." It is a process which expresses a clinical problem as a question, employs a systematic framework to locate and evaluate relevant research and integrates that information with clinical experience to guide clinical decisions.

In understanding the concept of EBD, it is helpful to clarify what it is not. It is not a "cookbook" approach to practice. EBD requires the integration of the best evidence with clinical expertise and patient preferences and, therefore, it informs, but never replaces, clinical judgement. Evidence-based health care recognizes the complex environment in which clinical decisions are made and the importance of individual patient circumstances, beliefs, attitudes and values.

A common misconception is that evidence-based practice is not feasible or is ineffective in the absence of randomized controlled trials. Although randomized trials are the "gold standard" for judging therapeutic interventions, they may not be available or they may not be the appropriate research design to answer other types of clinical questions. Evidence-based practice is a practical approach to clinical problems. It involves tracking down the best available evidence, assessing its validity and using "rules of evidence" to grade the evidence according to its strength.

EBD is not an ivory tower endeavour for armchair academics. Rather, it is the domain of practicing dentists. Although many of the skills for literature searching and critical appraisal have not been taught in the past in traditional programs, most medical and dental faculties are now including the concepts of evidence-based practice in their curricula.

There is an increasing body of literature to assist practicing clinicians in the acquisition of the skills needed to use evidence to guide practice. It has been shown that evidence-based methods can be learned by clinicians of varying backgrounds, at any stage in their careers.

Finally, evidence-based practice is not "old hat," which everyone already uses in day-to-day practice. The fact that scientific research evidence has built the knowledge base and has always provided the foundation for sound practice of the profession of dentistry is not in dispute. However, the context for change, and what has made the practice of EBD possible, is the electronic revolution. The research evidence can now be readily accessed at the "user" level by dentists or patients. Because the quality of research reports and, therefore, the accuracy of the conclusions drawn, vary tremendously, tools are needed to help dentists to properly interpret and apply the evidence.

The "information explosion" and the limited amount of time for keeping up with the literature has made the evidence-based approach valuable and effective for efficiently filtering what is truly important for clinical decision making from what is not.

Systematic Reviews

The foundation for the evidence-based approach is the systematic literature review, which differs significantly from the narrative review. Narrative reviews (the traditional review article) are usually broad in scope, written by experts and are often informal and subjective, supporting the author's views. Reviews by different authorities may arrive at different conclusions, leaving the reader wondering what the "truth" really is. While narrative reviews are useful for providing a general perspective on a topic and are appropriate for describing the history of a problem or its management, their selection of studies is subject to bias and the overall conclusions may not be accurate.

Systematic reviews summarize, analyze and report the combined results of a number of randomized controlled trials. They are done with the same rigor that is expected from the primary research, but the "unit of analysis" is the individual study rather than the individual patient. And since each study in the review is treated as a "unit of analysis," specific eligibility criteria must be used for its inclusion. The methodology of the review is thoroughly documented and reproducible.

Systematic reviews use explicit standards for evidence retrieval, assessment and synthesis. The strengths of systematic reviews include a clearly defined question, a comprehensive search strategy, explicit inclusion criteria, assessment of methodological quality of the included studies, synthesis of the data and a summary of the results.

The question driving the review should be focused. A "well-built" question will include four key elements: the population (for example, children in the primary dentition stage), the condition of interest (such as posterior crossbite), an exposure to a test or intervention (occlusal grinding to remove premature contacts) and a specific outcome (posterior crossbite in the permanent dentition). An example of a clear clinical question might be "Does removal of premature contacts by occlusal grinding of the primary teeth prevent posterior crossbite in the permanent dentition?"

When the results of two or more studies can be combined statistically, the review is called a quantitative systematic review or meta-analysis. Using this technique, statistical analysis of the results of multiple studies is done to obtain a single estimate of effect, leading to greater precision of the estimate and increased statistical power to detect the true effect of an intervention in the face of conflicting results. It is not always possible or sensible to include a statistical analysis in a systematic review. Controlled clinical trials may not have been done, may be of poor quality or may be too different from each other in terms of the population studied, the intervention used or the outcome which was measured. When the results cannot be statistically combined, but still use rigorous scientific methods to minimize bias, the review is called a qualitative systematic review. This type of systematic review is highly valuable for summarizing the existing data, for helping us to understand discrepancies in the available evidence, for informing us of the lack of reliable studies and in helping to define future research strategies.

The term "overview" is often used to describe a systematic review, whether it is qualitative or quantitative. The preparation of a systematic review is a major undertaking, requiring considerable time and expertise.

The Cochrane Collaboration

The Cochrane Collaboration is an international organization whose overall aim is to build and maintain a database of up-to-date systematic reviews of randomized controlled trials of health care and to make these readily accessible electronically. The history of the Cochrane Collaboration dates back to the influential 1972 publication, *Effectiveness and Efficiency*, by the British physician/epidemiologist Archie Cochrane. In this essay, Cochrane emphasized the use of scientific evidence, rather than intuition, expert opinion, anecdotal experience or tradition, in the evaluation of health care.

The main product of the Cochrane Collaboration is the Cochrane Library, an electronic library, issued quarterly, which contains databases of controlled trials and systematic reviews. The core work of the collaboration is done by the Collaborative Review Groups, which are formed by individuals who have a common interest in a health care problem and who work together through electronic means to prepare a systematic review on their chosen topic.

The Cochrane Oral Health Group (**http://www.ohg.cochrane.org/**) is based at the University of Manchester, UK. The Oral Health Group (OHG) has a growing and enthusiastic international membership. The group aims to produce systematic reviews which primarily include all randomised controlled trials (RCTs) in oral health. Oral health is broadly conceived to include the prevention, treatment and rehabilitation of oral, dental and craniofacial diseases and disorders. Oral Health Group protocols and reviews are published on the Cochrane Database of Systematic Reviews on The Cochrane Library. The work of the Group is carried out by over 650 members from 40 different countries around the world.

Clinical Practice Guidelines

Clinical Practice Guidelines (CPGs) are "systematically developed statements to assist practitioners and patients in arriving at decisions on appropriate health care for specific clinical circumstances." The overriding purpose of guidelines is to enhance, not dictate, clinical decision making and to provide practical recommendations to help practitioners improve the care they offer to their patients.

Different approaches have been used to develop guidelines, including expert opinion, group consensus and evidence-based methods. Although experts may have a wealth of scientific knowledge, clinical experience and credibility, guidelines based on expert opinion are usually unstructured and informal, and are open to criticisms of bias and conflict of interest.

Guidelines derived from consensus meetings are more structured and formal. They represent the views of various stakeholders and may be useful for creating uniform practice policies, particularly in areas of controversy. However, the research considered may represent a biased sampling and the evidence is generally not available for scrutiny. Furthermore, it is in areas of clinical controversy that the evidence-based approach is most useful in assessing the evidence and identifying weaknesses.

Evidence-based clinical practice guidelines (EB-CPGs) are structured and formal, and use rigorous, explicit and reproducible methods to assemble and evaluate the evidence. These guidelines are based on systematic reviews and incorporate values and preferences of patients and practitioners.

The process of creating a well-developed EB-CPG includes external review and comment by those who will be using the guidelines - for example, a wide range of clinicians, as well as patients or their representatives.

Systematic Reviews Appraisal

Systematic reviews have most often been done for questions relating to therapy, although they can and have been done for all types of questions. While widely accepted standards have been developed for the conduct of systematic reviews for issues related to therapeutic questions, agreed-upon standards and critical appraisal techniques for reviews which synthesize the results of observational studies remain undeveloped at this time. The following guidelines will enable you to judge the validity and usefulness of a systematic review of RCTs addressing issues of therapy.

Was a clearly stated question asked?

The question being addressed by the review should be focused in terms of the population being studied, the intervention given and the outcomes being considered. If these key elements are not present in the title or the abstract, you should go on to the next title.

Were the inclusion criteria appropriate?

Specific inclusion and exclusion criteria related to the population, intervention, outcome and acceptable study design must be well defined and clearly stated. This allows the reader to decide if the appropriate studies were included. In addition, this permits the review to be replicated and avoids preferential citation of studies that support a particular viewpoint.

Was a comprehensive literature search done?

It is important that all pertinent studies are included and that important ones have not been missed. There is evidence that a number of high-quality, methodologically sound studies remain unpublished ("publication bias") because their results are negative. The authors of the overview should clearly state their search strategy, including key words and databases used. Ideally, the search should include other sources, such as multiple databases, reference lists from relevant papers, conference proceedings and personal contacts with experts.

Was the validity (quality) of the primary studies assessed?

It is important to know the quality of the included studies. If many of the studies were weak, their combined results will not be believable. It is helpful to the reader if a study-by-study critique is presented in a table or if there is a thorough discussion of the methodological quality of the included studies.

Was the assessment of the studies reproducible and free of bias?

Decisions regarding which studies met the inclusion criteria, the validity of each primary study and the meaning of the data within each study involve judgment on the part of the reviewer. All such judgments are susceptible to error and unintentional bias. To overcome this, 2 or more authors of the review should perform each of these steps independently, blind to each other's decisions, and then come to agreement by consensus. Ideally, the names of the authors of the primary studies and their affiliated institutions should be deleted during the review process.

Were the results similar from study to study?

Even with fairly strict inclusion criteria, there is bound to be some variation in the results of the eligible studies. The authors should present the salient features of each study in terms of the included patients and the stage or severity of their disease, the intervention (for example the dose, route or timing) and the way in which the outcome was measured, and they should try to explain the variability of the results.

Were the findings of the studies combined appropriately?

As a reader, you will want to know if it was reasonable for these studies to be combined in a systematic review, keeping in mind that no 2 studies would (or should) ever be exactly the same. If the studies seem too dissimilar, they should not be combined mathematically. A statistical test can be done to see if the results are different merely by chance. If this test indicates that the study results are similar enough to combine mathematically, a meta-analysis is done. A "vote count," that is, a vote counting the number of positive studies versus the number of negative studies is not appropriate. The reason for this is that small studies may be "underpowered," i.e., there may not have been a large enough sample size for the study to have sufficient power to detect a difference in treatment effect between the experimental and the control groups. One of the major advantages of meta-analysis is that the results of a number of small but similar studies can be combined to achieve a large enough sample to detect an effect.

Were the authors' conclusions supported by the data?

The results of each study must be reported in enough detail to allow the reader to judge the grounds for the reviewers' conclusions. Are the conclusions justified, given the methodological quality of the studies? Do the results and conclusion answer the original question asked?

Will the results help in caring for patients?

As with all research, you need to decide if your patients and your practice setting are similar to the patients of studies included in the review. Are you able to implement the intervention in your practice and are the potential benefits worth any potential harm or cost?

Conclusion

A well-designed randomized controlled trial is the strongest research design for clinical trials. The systematic review is a powerful way to assemble multiple studies and synthesize their findings. In both cases, the credibility of the research is determined through the use of critical appraisal techniques.