

Evidence-based prosthodontics: 25 years later



This editorial relates the events and behind-the-scenes vision and activity of the many prosthodontists and prosthodontic organizations that brought evidence-based dentistry (EBD) to our specialty.

In 1986, Jim Anderson, a prosthodontist at the University of Toronto, was granted a sabbatical year to study clinical epidemiology at McMaster University Medical School in Hamilton, Ontario, Canada. The professor was David Sackett, a nephrologist and epidemiologist who, in 1967 and at the age of 32, had been awarded the department chair. He combined his skills in epidemiology and biostatistics into a method not only of evaluating and appraising the quality and validity of scientific literature but also of clinical action. He has been given the title, "Father of Evidence-based Medicine," a term coined by one of his students, and his department grew to such numbers that it was described as "the department that ate a medical school." Even in 2017, it is the largest medical school department in Canada. In 1995, Sackett repeated a 5-year hospital residency because, although he was a professor, he felt he was not a very good doctor. He personally confirmed what he had been teaching his medical colleagues for years: valid, up-to-date (via immediate computer search), patient-centered treatments can be delivered even in a busy hospital ward. After his sabbatical, Jim Anderson returned to Toronto to be the first to bring the McMaster model of clinical epidemiology to dentistry.

In 1989, the Federation of Prosthodontic Organizations sponsored a national symposium held at the Mayo Clinic, Rochester, Minnesota to address current and future aspects of prosthodontic education, research, and education for the 21st century. The section report on research was chaired by George Zarb, who laid the groundwork for implementing Jim Anderson's Toronto educational initiative. A research symposium committee was organized with representatives from many prosthodontic organizations and academic institutions under the leadership of Dale Smith and populated by George Zarb, Cosmo Desteno, Steve Bergen, Jack Gerrow, Robert

Schweitzer, and Jim Anderson. Discussions ended in negotiations with McMasters University and the esteemed Sackett faculty and the creation of a specially designed program to educate 10 prosthodontists in the understanding and teaching methods of evidence-based medicine. In turn, these 10 would bring their newly acquired skills to prosthodontic program directors and educators in North America. The stage was set for McMaster University Department of Epidemiology and Biostatistics to change its diet and to "eat the dental specialty of prosthodontics."

In 1993, the 10 attendees were defined as those with a strong relationship to the major prosthodontic journals: *The International Journal of Prosthodontics*, *The Journal of Prosthetic Dentistry*, *Journal of Prosthodontics*, and *International Journal of Oral and Maxillofacial Implants*. The 10 individuals were George Zarb, Jim Anderson, David Felton, Gary Goldstein, Jack Preston, Patrick Lloyd, Rhonda Jacob, Alan Carr, Glen McGivney, and Brien Lang (Fig. 1).

In 1993 and 1994, the group of 10 traveled to McMasters and attended two 1-week courses with



Figure 1. Evidence-based dentistry workshop attendees at McMaster's University. Back row (left-to-right): Gary R. Goldstein, David A. Felton, James D. Anderson, Jack D. Preston, and Brien R. Lang. Front row (left-to-right): Alan B. Carr, Glen P. McGivney, Rhonda F. Jacob, George A. Zarb, and Patrick M. Lloyd. (Photograph from *J Prosthet Dent* 2001;85:525-6.)

small-group, self-directed, problem-based learning/teaching methods pioneered by the McMaster group. Faculty were from the medical school and included George Browman, Gordon Guyatt, Mark Levine, and Ray Gilbert. In the first week, the Workshop on How to Teach the Critical Appraisal of Clinical Evidence covered 8 units: Therapy, Diagnostic Test, Overview, Clinical Measurement, Prognosis, Causation, Quality of Care, and Economic Evaluation. In the second week, the Research Methods Workshop reviewed the knowledge base required to prepare a research protocol. Topics included establishing the research question, selecting design architecture appropriate for the question, sample selection, and size, and describing the maneuver, measurement, outcomes, and statistical analysis. The goal was for the group of 10 to disseminate their synthesis of the experience working with the McMaster faculty in preparing dental examples and teaching modules to the prosthodontic community.

In 1994, an editorial written by George Zarb and echoing the sentiment of his colleagues was published simultaneously in all 4 journals represented by the attendees. Zarb's editorial elegantly described the state of our "treatment dilemmas" due to lack of clinical evidence to support one treatment decision over another. In this editorial and in a subsequent 1995 announcement for upcoming International EBD symposia, he recognized the support that carried the EBD mission forward, crediting the Federation of Prosthodontic Organizations and the Editorial Council of *The Journal of Prosthetic Dentistry* (ECJPD). The Editorial Council under Ken Adisman pledged significant financial support from the outset of the initiative.

In 1995 and 1997, the original group of 10 assisted by George Browman, held 2 international research symposia sponsored by the American College of Prosthodontics and the ECJPD. The target audience was prosthodontic educators, who were given the tools to begin teaching their students the concept of EBD. The curricula included critical appraisal exercises directed at core clinical decisions related to diagnosis, harm, therapy, prognosis, and systematic review. Discussion of research design and measurement issues was directed at various clinical research questions of interest. The attendees were encouraged to become involved with the Cochrane Collaboration research activities established in 1993 by David Sackett, who was the first chair of the Cochrane Steering Group. In 1997, several other dental specialties and dental educators attended the symposia, having observed the expertise that was being introduced to the dental community by this prosthodontic initiative.

In 2000, in the first 7 issues *The Journal of Prosthetic Dentistry* published a series of 8 articles written by the 10 attendees and associates to be used as guides to understanding and appraising the validity of clinical research and its applicability to the patient in question. The first 2

articles described the concept of EBD.^{1,2} The next 2 provided information regarding study design and measurement issues that are helpful for determining the strength of evidence and the quality of outcomes.^{3,4} These articles were followed by core evidence-based articles designed to help readers determine the validity and usefulness of publications to assist clinical decision-making. These core articles were categorized as diagnosis,⁵ prognosis (probable course of a disease),⁶ harm⁷ (observational studies of exposures that may cause harm), and therapy⁸ (whether a specific treatment is better than another course of action). Also presented was the systematic review, which is a structured review format that uses explicit methodology for conducting rigorous reviews of the literature.

In 2002, Gary Goldstein was the guest editor and author of, "Evidence-based dentistry" in *Dental Clinics of North America*. Several of his prosthodontic colleagues and others in the epidemiology specialty were authors in the edition. In 2009, another *Dental Clinics of North America* called, "Evidence-based dentistry in the private office," was held, and in 2017, "The science and art of evidence-based pediatric dentistry," was published in *Dental Clinics of North America*.

From 1999 to 2002, the Academy of Prosthodontics allotted one half day of its annual scientific sessions to the concepts of EBD. The half-day included guest speakers and break-out sessions implementing EBD in reviewing various clinical questions and available literature. Academy fellows Alan Carr, Rhonda Jacob, Sree Koka, and Steven Eckert were the planning committee and facilitators for the sessions. The American Dental Association Center for Evidence-Based Dentistry was established in 2007, and the *Journal of Evidence-Based Dental Practice* was first published in 2002.

Many dental schools and dental organizations have implemented EBD in their curricula. Problem/patient/population, intervention/indicator, comparison, outcome (PICO) questions and critical appraisal topics drive literature searches in the clinic and in seminars. The commitment of prosthodontics to the implementation of evidence-based decision-making is demonstrated by the fact that EBD education is now a prosthodontic standard for all dental schools in the United States according to the Commission on Dental Accreditation. Educated audiences demand more quality of research design and validity of assessment of outcomes from speakers at scientific sessions.

The concepts of evidence-based medicine can be applied across all health disciplines and also further afield. For example, Evidence-Aid (www.evidenceaid.org) was established after the Indian Ocean tsunami in 2004 with input from Cochrane to collate and use knowledge from systematic reviews to "inform agencies and people planning for, or responding to, disasters" in the humanitarian sector. Regardless of the application,

health or humanitarian, identifying interventions that are known to be beneficial, are known to be harmful, or have outcomes which are not yet well understood relies upon being able to find and understand the evidence. In dentistry, collation of evidence is often challenged by the length of time it can take for outcomes to become apparent. This makes it difficult to design and fund investigative studies and to track patients forward in time. However, it must be remembered that EBD means that clinical prosthodontists seek the most appropriate evidence and assess it in light of their own abilities and their patients' wishes, even if that evidence is not considered to be of the highest quality.

The technology boom has assisted in the identification of appropriate evidence and has facilitated EBD. The MEDical Literature Analysis and Retrieval System (MEDLARS) Online replaced the manual Index Medicus system in 1971, with MEDLINE launched free to the general usership via PubMed in 1997. Other bibliographic databases and search engines across many languages are now either freely available or accessible through library subscriptions. EBD development paralleled technological changes as we moved from desktop computers to laptops, with evidence now available on portable tablets in every office. Barriers to accessing information and evidence are ever decreasing, and quality syntheses and guidelines for applying that evidence are ever increasing.

The evidence tree has also evolved, helping clinicians access and translate evidence into their practice. Most clinicians know the evidence tree as having case reports and expert opinion at the bottom of a pyramid which then culminates with systematic reviews at the top. The 6-S hierarchy of evidence-based resources model was introduced in 2009 acknowledging the expansion of evidence beyond that of systematic reviews.⁹ Single studies continue to form the first layer, but above systematic reviews (now called syntheses), synopses and systems have been added. Synopses are critical appraisals of studies or reviews written by epidemiology experts and available through resources such as TRIP database (www.tripdatabase.com.au) and *Evidence-Based Dentistry* (www.nature.com/ebd/), so that practicing clinicians can access appraised evidence in a meaningful and timely manner. Finally, in some areas, clinical system guidelines have been developed, and this is now considered to be the highest evidentiary layer.

Although evidence in prosthodontics is not yet sufficiently mature to offer system guidelines, we have good access to synopses and continue to work with and improve our evidence base. We recognize that different evidence is needed to answer different prosthodontic questions and that different study designs are more

appropriate for the exploration of different prosthodontic outcomes; for example, patient-centered outcomes with cross-sectional surveys, lifespans of implant prostheses with cohort studies, or dental material choice with randomized clinical trials. Clinically, when providing prosthodontic treatment, we almost always make and guide daily decisions by weighing the costs of treatment against potential benefits. To do so, we must assess evidence from a variety of resources.

Approximately 25 years have passed since evidence-based prosthodontics became the headliner for prosthodontic annual sessions, symposia, study clubs, and resident seminars. Like the introduction of root-form dental implants in North America, it also grew under the leadership of our prosthodontic colleagues at the University of Toronto: a select few understood the potential, those few became trained, and they then became the trainers. A whole generation of prosthodontists may not even recognize that implant and evidence-based prosthodontics are being taught to them by senior staff that learned by traveling to seminars, performing on the job, and then developing curricula for their own schools and practices.

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