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The Necessity of an Evidence-based Approach to Diagnosis and Treatment

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Today, the concept of evidence-based healthcare surrounding our clinical practice of dentistry is discussed more than ever. However, many times this term is used to define anything *but* "evidence-based dentistry" (EBD).

The term "evidence-based" has evolved through certain iterations through the years. Archie Cochrane initiated the discussion of putting into action the concept of science-based medicine when in 1971 he published *Effectiveness and Efficiency: Random Reflections of Health Services* (Cochrane 1972). In 1992 a clinical epidemiology group at McMaster University in Canada (Evidence Based Medicine Working Group 1992) published a paper on evidence-based healthcare (EBM Working Group 1992). Their article described their challenge to adopt an "evidence-based practice" (EBP) approach since it "de-emphasizes intuition, unsystematic clinical experience and pathophysiological rationale as sufficient grounds for clinical decision making." The paper was written with the clear intent of placing a greater emphasis on a systematic appraisal of the evidence.

The first well-defined use of the term "evidence-based" in the UK was in a 1996 *British Medical Journal* article by David Sackett et al. (Sackett et al. 1996) and was defined as the "... conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."

The term "current best evidence" is the operative word here, because it implies that our best available evidence should by definition change as we progress through more research findings, to the point that what was true as the best available evidence even as recently as ten years ago in dentistry in some respects is not even true today. Many examples come to mind, such as digital technologies in scanning, designing, milling, or printing restorations and appliances; the newer adhesive systems; newer generations of composites; more nonsurgical and adjunctive periodontal therapies; different dental implant systems, shapes, sizes, components or engineered surfaces; and more procedure-specific use of biomaterials as well as therapies, all due to better applied research results, and so on.

The American Dental Association (ADA) has defined the concept of EBD as:

> 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.
>
> *(Sackett et al. 1996)*

EBD has five components. This premise is simply based on the notion that to perform a scientific search for the current best evidence, one must be able to interpret the clinical scenario, translate it into searchable terminology, and then find the best evidence by critically assessing the quality and the appropriateness of the published evidence to address the identified clinical scenario. The five components are:

1) **Translate a clinical problem into a question.** For example: A new patient who is pregnant comes to see you with a chief complaint that she wants a second opinion on her need for periodontal surgery. She has heard periodontal disease may cause low-birth-weight babies and asks, "Do I really need surgery, or could I just have dental cleanings (scaling and root planing) to prevent a low-birth-weight baby?" An easy method to translate a clinical scenario into a searchable format is by using the PICO structure. PICO is an acronym for **P**roblem, **I**ntervention (or Index, i.e., a category or condition), **C**omparison, and **O**utcome. So, by using PICO, one would devise the following structured format for the example described above:

   How would I describe the dental **P**roblem or population?

   "In *pregnant patients* ..."

   Which main **I**ntervention or index am I considering?

   "With *periodontal disease* ..."

   What is the main **C**omparison or alternative?

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"Compared to *pregnant people (patients) without periodontal disease*."

What is the **O**utcome to be studied?

"Is there a greater risk of "*low-birth-weight babies?*"

2) **Effectively search for the best evidence.** For this component, one must determine which databases to search and then use the appropriate databases and search filters to find the best evidence. The most common database is Medline (accessible via many free Internet portals such as www.pubmed.gov); however, there are many highly specialized databases such as Psychlit for behavioral research, Cancerlit for cancer literature, and NHSEED for economic evaluation research (UK) (see Chapter 4) As a source of high-level study designs, the Cochrane Oral Health Group (OHG), which originated in New England in 1994 and moved to Manchester (UK) in 1996, now has a registry (at the time of print) of 174 reviews, 28 protocols, and 214 subtopics in dentistry (https://oralhealth.cochrane.org). Summaries of the reviews are listed on the OHG website.

   The term "filter" refers to the strategy for condensing thousands of articles into a more refined or limited set of relevant data. Filtration could be based on "human" topics, "English" language articles, a certain period of time (certain decade of research and beyond), and so on (many more filtration strategies are available). For the abovementioned example, a search of the best evidence yielded the following number of articles (at the time of print):

   - 199,124 articles that include the word "pregnant"
   - 100,793 articles that include the words "periodontal disease"
   - 716 articles that include the words "pregnant" and "no periodontal disease"
   - 59,888 articles that include the words "low-birth-weight": Clearly, reading more than 360,000 articles to address our clinical scenario is neither indicated nor necessary. By using just "human" subjects and "English" language as our limits for our filtration strategy, we came up with 198 articles that describe the association (or lack thereof) between periodontal disease in pregnant patients and low-birth-weight babies. A further review of the articles and additional filtration (specificity and sensitivity) yielded 37 articles that describe the potential link between pregnant patients with periodontal disease and the risk for preterm and low-birth-weight babies.

3) **Critically appraise the evidence.** One must critically read and evaluate the basis of the articles at hand (all 37 of the articles). This means that for this component level, one must assess at some foundational level the quality of the research methodology, the study design, the statistical analyses, and the conclusions that are published in each research article. It should be noted that the mere fact that an article is published (in a reputable journal or otherwise) does *not* mean that the study design, the research methods, the statistical analyses, or the conclusions were/are appropriate. Certain clinical or patient-centered questions can be best answered and more scientifically based if they are investigated through specific research designs or methods. For example, randomized control trials are suitable and indicated for the majority of therapeutic interventions, whereas cohort studies are suitable in design to answer questions on prognosis. Critical appraisal skills are evaluative skills that are taught and developed over time with appropriate supervision from knowledgeable and skilled individuals.

   For our example, there are 37 studies that show some level of association between low-birth-weight and periodontal disease. The discrepancies come from the use of methods used in conducting the research, the appropriateness of the statistical analyses in interpreting the data, the various study designs compared in the studies, the process by which the data were collected, the criteria used for inclusion or exclusion of risk factors, or the lack of such parameters, and so on. However, care must be taken not to introduce bias, conscious or unconscious, at this step. Filters cannot be arbitrary or be used to eliminate studies that do not seem to support the beliefs of the evaluator of the studies. While the critical review of pertinent studies is intended to eliminate bias, there is that potential every time a decision is made on which studies to include. As a hypothetical example, a filter of studies of at least 9 months duration might be imposed, but the majority of studies are of 6 months duration. It is possible that the majority of studies of 6 months contradict one or two 9-month studies. Eliminating the shorter studies is eliminating valuable information and if only 9-month studies are reported, the outcome is biased.

4) **Apply appraisal results to clinical practice.** At this time, if one critically appraises and assesses the quality of the research findings for our abovementioned clinical scenario, the evidence is mounting and suggests a new risk factor—periodontal disease. Pregnant women who have periodontal disease may be seven times more likely to have a baby that is born too early and too small.

   More research is certainly needed to confirm how periodontal disease may affect pregnancy outcomes. It appears that periodontal disease triggers increased levels of biological mediators that induce labor. Furthermore, data suggest that women whose periodontal condition worsens during pregnancy have an even higher risk of having a premature baby.

Therefore, by using the most current published clinical evidence available, clinicians in private practice can make the judicious recommendation to their patients that periodontal disease may in fact be a significant risk for a preterm, low-birth-weight baby.

We ask you, the reader, a rhetorical question now: Is this in fact what we are currently telling our patients? If not, then why? More importantly, what is the level of appropriate scientific evidence that supports these communications or recommendations with our patients? Certainly, then, an understanding of the levels of evidence in scientific research becomes necessary for any clinician to judiciously take the research recommendations and translate them to clinical practice (see Chapter 4).

5) **Evaluate application step and outcomes.** As with any treatment modality, good science and good patient care must be evaluated once it is rendered. Some therapy or treatment (or preventive care) can be assessed shortly after it has been rendered, and for other occasions, the evaluation of the applied care must be assessed within a much wider time span. Nevertheless, evaluation of outcomes is a necessary component of responsible and appropriate evidence-based healthcare.

From a study design standpoint, identifying whether periodontal disease actually causes preterm, low-birth-weight babies is very difficult to measure with the presence of other variables.

Ethical issues also arise in a clinical trial if periodontal treatment is withheld for an indefinite period from half of the subjects, so technically this question cannot be measured well.

Regardless of whether this association is proven or not, dentists have nothing to lose by encouraging their patients to take care of their teeth.

Other salient topics with respect to periodontal disease and systemic disease include the suggested link between cardiovascular disease and periodontal inflammation. There is a wealth of cross-sectional studies (which yield limited assessment opportunities) that suggest the association is not random, but longitudinal studies that evaluate outcomes (and allow for multiple assessments) that predict cardiovascular events in people with periodontitis have been lacking. New evidence has been recently reported that independently associates major adverse cardiovascular events (MACE) with periodontal disease activity. Periodontal disease activity is defined as active inflammation of the periodontium, as opposed to a history of periodontal disease that is most often defined by radiographic bone loss. In this study, periodontal inflammation was a significant predictor of MACE. Interestingly, investigation of the mechanism for this observation is consistent with increased periodontal inflammation causing increased arterial inflammation (Van Dyke et al. 2021). While the study and the proposed mechanism seem plausible, it is a single study that has to be repeated in other settings. Thus, advising patients that the association has been proven is still premature. However, advising patients that periodontitis is associated with increased *risk* for developing cardiovascular disease is supported by literature using evidence-based evaluations (Sanz et al. 2020; Tonetti and Van Dyke 2013).

Problems with Introducing EBD

In the past 20 years, dentists have become more aware of the existence of EBD and generally, the progress from initial skepticism to a more positive attitude of the use of EBD is palpable among the members of the profession. This observation is reflected by the formation of the ADA's Center for Evidence Based Dentistry, the implementation of EBD concepts in dental school curricula dictated by new ADA Commission on Dental Accreditation (CODA) standards for teaching dental students, and by journals and meetings/conferences all over the world emphasizing EBD concepts.

However, the main barriers to the implementation of EBD into practice have also been identified in many studies (Iqbal and Glenny 2002; Sbaraini et al. 2012; Straub-Morarend et al. 2013). So why are dentists not putting EBD into practice?

Amount of Evidence

There are currently about 500 journals related to dentistry and not all are relevant to all areas of dental practice, nor can a busy practitioner read any more than a small handful of articles routinely.

Quality of Evidence

Because enhancing career prospects in academia is partially tied to the number of publications someone authors, much of the ever-increasing volume of evidence produced is not necessarily to increase the knowledge base, which in essence compromises quality. In addition, a number of publications that are widely read are not subject to peer review, and even when peer review exists, there is always the unfortunate reality of publication bias (defined as the tendency by both researchers and editors to publish positive reviews or results).

Dissemination of Evidence

History has shown that even in the presence of good evidence, the application phase of EBD can take many years to become the norm or standard in practice. Unless good

methods of dissemination are available, good evidence can go to waste. Conversely, even with scant or insignificant differences in evidence from the *status quo*, many new products and procedures have been introduced to the marketplace simply because interest and desire exists to integrate a change in practice.

Practice Based on Authority Rather than on Evidence

Common practice in professional development and continuing education demonstrates that the dental school model, which uses techniques or therapies based on views of authority rather than evidence, may lead to the wrong or outdated treatment being performed.

Advantages of EBD

What Constitutes Evidence?

Personal clinical examination, including specific findings from history and results from tests, constitutes evidence. Research evidence is a manifestation of a much larger scale of interventions and, therefore, becomes a stronger tool for clinical decision making because it extends beyond individual experience. This should not, however, replace individual experience but rather anchor our clinical experience from years of practice. Sound reproducible research outcomes should enable clinicians to recognize gaps and uncertainties in their knowledge rather than wait for the next patient to expose our inadequacies. This implies a marriage between the research process and the clinical application of that process, hence the need for a continuous process of reading, learning, and applying a dynamic field of information.

What Is Good Evidence?

The randomized controlled trial (RCT) study design is the gold standard for evidence for treatment-related questions. An even better level of evidence is a systematic review or a meta-analysis of a series of RCTs. However, this is only true for the clinical question regarding therapeutics. For other clinical questions, a study design hierarchy exists to determine the levels of evidence (see Chapter 4). This means that in the EBD process, no evidence is considered to be bad evidence; there are just levels of applicable good, better, and best evidence.

Finding and Making Sense of Evidence

After finding the evidence, one needs to make sense of it. This appraisal should be critical; after all, no research design is perfect, and the health status of a person is at stake. The Critical Appraisal Skills Program (CASP) at Oxford University has developed a worksheet that can be used while reading and interpreting published articles to make sense of the evidence (https://www.cebm.ox.ac.uk/resources/ebm-tools/critical-appraisal-tools). The aim of the critical appraisal is to systematically consider the validity, results, and relevance to our own clinical practice.

EBD improves the effective use of research evidence in clinical practice. If used judiciously, it favors the early uptake of new and better treatments or results in the early rejection of ineffective treatments. It uses resources more effectively. For example, a systematic review of materials may lead to the earlier adoption of the most effective ones and the subsequent reduction in replacement levels, thereby saving resources.

EBD relies on evidence rather than authority for clinical decision-making. Regular reviewing of currently available literature should develop us as practitioners, so we attain the skills to evaluate evidence for ourselves based on our own experiences rather than have someone interpret the data for us.

To use this approach, we need to develop new interpretive skills for identifying clinical problems, searching literature by using conventional and electronic means, and improving our critical appraisal skills. In the same spirit, this book encompasses practical evidence-based developments in diagnosis and treatment planning for a periodontal patient.

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