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Review article

Evidence Based Dentistry skills

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ABSTRACT

Decision-making based on reliable evidence is more likely to lead to effective and efficient treatments. Evidence-based dentistry was developed, similarly to evidence-based medicine, to help clinicians apply current and valid research findings into their own clinical practice. Interpreting and appraising the literature is fundamental and involves the development of evidence-based dentistry (EBD) skills.

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INTRODUCTION

Dental students, graduates, postgraduates or practicing professionals are long-life learners. They are always and daily on the road to increase their knowledge, improving their techniques and modifying their treatment strategies according to the current advances and new scientific information and evidence published via credible scientific media relevant to dental field.

The literature is replete with case reports, case studies, expert opinions, cohort studies, randomized and non-randomized clinical trials; such studies are the source of knowledge and reason for adopting new treatment approach or philosophy.

The most important question is how can the dentiologist inquire, request and search for the evidence among the available literature, evaluate the results for applicability in the daily practice and achieving the ultimate goal in providing best educated service and meeting needs of their patients and communities.

We will start with defining the question "What is evidence?"

Evidence is anything like reasons, documents, conclusive statements etc. used for believing and deciding that something is or is not true; evidence is the exclusive conclusion and proof that is used to demonstrate, determine the very fact or point in issue; used to either support or refute a scientific theory or hypothesis [1].

What is Evidence Based Dentistry (EBD)?

According to the definition by the American Dental Association "Evidence based dentistry (EBD) is an approach to oral health care that require the judicious integration of a systematic assessments of clinically relevant scientific evidence, relating to the patients' oral and medical condition and history with the dentist's clinical

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expertise and patients' treatment needs and preferences [2]. That is why; the principle in adopting new treatment philosophy or strategy, new procedure or different decision approach depends largely on the evidence of benefit and not on the evidence without benefit (or harm). By observing so, we are assuring the application of proper treatment and doing the right thing for the right patient at the right time.

It is important for us to understand that EBD is an approach to practice, an approach to making clinical decisions and is just one component used to arrive at best treatment decisions. EBD is a method to stay up to date on the current science.

Why is EBD important?

EBD is the highest and strongest evidence up-to-date obtained from well-designed Meta-analysis, systematic reviews, controlled trials and non-controlled trials in order of power. EBD can be a valuable source of encouragement for the practitioners in primary dental care where he can easily look for and make sense of the evidence available in order to apply it to everyday problems [3]. Sometimes it is not clear how the clinician's expertise is incorporated into EBD?

Science is data, information, statistics and knowledge. It does not have judgments or values, and it cannot tell us what to do. That is the role of the dentists. He/she must understand the data, and the information revealed with the data. This is incorporated with judgments and values to develop recommendations and help a patient make a decision about his/her individualized treatment.

The danger is in ignoring the science. Science should be embraced and utilized to form the basis for clinical decisions. It informs, but does not dictate, decisions. The clinician forms the judgment on how the science can be applied, and the patient's needs and preferences form the value-basis for the individualized decision [4].

What is 'level of evidence?

It reflects power of the evidence to which one can be confident that an estimate of effect or association is correct (unbiased) [5]. Levels of Evidence is to help clinicians critically review the external evidence they locate, Sackett et al. developed a hierarchical model to categorize most studies. It is important to note that these levels of evidence are not a rigid set of rules, but serve only as a set of guidelines for the critical appraisal of the literature.

According to Sackett et al. (1996) the randomized trial (especially the systematic review of randomized trials) has become the "gold standard" for judging whether or not a particular treatment is beneficial [5].

The practice of EBD is not restricted to randomized trials. Studies from other levels may be better meet your needs for information or may be better in terms of quality. For example, although the cohort study design ranked lower than that of the randomized controlled trial, it may be the highest level of evidence (excluding systematic reviews) for other aspects of patient care (e.g., validity of diagnostic tests, assessing prognosis) or when randomized controlled clinical trials cannot be performed due to ethical concerns (e.g., study of harmful interventions or exposures).

Evidence levels in EBD

The evidence levels in EBD are [6-7]; i, Meta-analysis and systematic reviews (review of completed studies). ii, Randomization controlled trails (experimental with randomization). iii, Quasi- experimental (experimental without randomization). iv, Cohort Studies (observational). v, Case control studies (observational). vi, Case series studies (observational). vii, Case reports (observational). viii, Ideas, editorials, Experts' opinions. ix, Animal research. x, In vitro (test tube) research.

What are the levels of primary evidence?

If there are no clinical practice guidelines, critical summaries, or systematic reviews on your topic of interest, then you need to look to primary evidence to answer your clinical question [6-7]. The level of evidence does depend on the question that you are asking; however, traditionally evidence is depicted according to a pyramid, where higher levels on the pyramid represent higher levels of evidence, which in turn indicates a lower risk for bias. The highest level of primary evidence is a randomized controlled trial or an RCT. This is the highest level of a clinical study. If a trial is not randomized, but it has a control, then it falls one level below the RCT. There are other types of clinical studies like the cohort studies, case control, case series and case reports, which are called "observational studies". Right under the clinical studies in respect to level of evidence is the expert opinions especially those developed through consensus panels followed by animal research and bench-top research. In an IDEAL world we prefer RCTs to answer all our questions, especially with respect to "what interventions perform the best?"

Fundamental types of clinical questions

The fundamental types of clinical questions are; i, therapy. ii, etiology. iii, diagnosis. iv, prognosis. It is important to correctly identify the category of study, because, to answer your question, you must find an appropriately designed study [7] (**Table 1**).

Table 1. The categories of study and suggested best method of investigation

	Study Category	Suggested Best Method of Investigation
i.	Therapy	RCT > cohort > case control > case series
ii.	Diagnosis	Prospective, blind comparison to a gold standard
iii.	Etiology	RCT > cohort > case control > case series
iv.	Prognosis	Cohort > case control > case series

Optimum patient care depends on three main domains: I, Best available scientific evidence; ii, dentists' proficiency, clinical expertise and judgments; iii, patients' needs and preferences. Only and then we can say the dental practitioners is actually running Evidence Based Practice.

What is Evidence Based Practice (EBP)?

EBP is defined as the integration of best available external clinical evidence from systematic reviews with the clinicians' clinical expertise and patients' values and expectation into the decision making process for best patients' care. EBP Uses best evidence, systematic appraisal of quality of evidence, objective, transparent, evidence with less biased, and acceptance levels of uncertainty.

By external clinical evidence we mean the best available effective and current information regarding etiology, diagnosis, prognosis and treatment; by clinical expertise we mean the ability to use our clinical skills and past experience to rapidly identify each patient's unique health state and diagnosis, their individual risks and benefits of potential interventions, and their personal values and expectations.

By patients' values we mean the individual preferences, concerns and expectations each individual brings to a clinical encounter and which must be integrated into clinical decisions if they are to serve the patient. When these three elements are integrated, clinicians and patients form a diagnostic and therapeutic alliance which serves to optimize clinical outcomes and quality of life.

The central and simple message of evidence-based practice is that best research evidence needs to be combined with patient values and circumstances, along with practitioner expertise. The goal is using best evidence to improve patient care.

Barriers to change:

The barriers to change are; i, time; ii, access; iii, complexity of information. Understanding the changes and a willingness to move forward puts us face to face with the challenges that confront us. But this needs time. I know I don't have time. In the course of running a busy practice, it is difficult to find the time to conduct a literature search, read all identified articles, critically assess the articles, and come to some conclusion. Even if I have time, the typical private practice or small practice nature of most dental offices does not provide access to a wide variety of journals.

Finally, many articles published in scientific formats are not user-friendly for chairside application. But these are just some walls we need to learn to climb. Many scientific agencies offer several resources to help apply evidence in practice. So our goal should be to find such sources and use this information. If you have limited time, consider starting with clinical practice guidelines and the secondary sources of evidence such as summaries and systematic reviews.

Why Practice EBD?

1. Helps filter immense amount of information that emerges in the literature.
2. Effective method of keeping up with the most current research.
3. Provides information on how similar cases treated.

In contrast to EBP, in traditional practices practitioners depend on what they learned in school and on what they hear or see during dental meetings. The part in search for the evidence power, quality, validity and applicability is missing in day to day practice and in their clinical decisions. There bases for the knowledge acquired is a yes or no answers to the problem, subjective, opaque, potentially biased black and white conclusions [8- 10].

How does EBD work? [2- 6- 11]

Identify Clinical Problem

Define the issue, clinical problem or clinical case and present it in a very well-built research question. This question should be directly relevant to patient's problem and phrased in a way to direct our search to relevant and precise answers.

Asking clinical problem-relevant question

Develop a clear, well-structured clinically focused question. In this step is to define a clinically relevant, focused question. In defining a question we must pay attention to four elements – what is the population (children/adults or smokers/non-smokers etc.), what is the intervention, what are we comparing it to and what is the outcome that we need?
There are two main types of questions that will determine and efficient and relevant search strategy:

Background questions: The question inquires descriptive information concerning clinical conditions, diagnostic tests or treatment approaches. These types of questions are dealing with foundational knowledge such as definitions of a matter, cases, situations and mechanisms of actions. Examples of background questions are "What is chronic pulpitis?" and "How does corticotomy accelerate orthodontic tooth movement?"

Foreground questions: The question here inquires information about etiologies and harm, diagnosis, prognosis, therapies and preventions that directly helps in clinical decision making. Example of foreground question is "Are self-ligating brackets more efficient in reducing orthodontic treatment time as compared to conventional standard edge wise brackets?"

Then, present the question of interest in a PICO form. Such question should contain four elements: I, Problem/ Issue/ Subject (P); ii, Intervention/ Exposure (I); iii, Comparison Intervention/ standard reference (C); iv, Outcomes (O).
The acronym PICO arises from these four elements collectively gives us the "PICO question" which makes the search for answers and evidences easier and faster. From the PICO question we would be able to elicit and

combine the appropriate terms to include in search key words bar of whichever searching service is accessible

Example of a good question: In patients with periodontal disease, will short-term systemic antibiotics, when compared to surgery, reduce pocket depth?

P, patients with periodontal disease; I, short-term systemic antibiotics; C, Periodontal surgery; O, reduce pocket depth.

Search and acquire the best evidence

Identify the best type of study design that would answer the question of interest. In this step focuses on systematically searching for evidence published or unpublished, that may help to answer the question.

For questions that inquire about prevention or therapy, well designed randomized clinical trials should be preferred over observational studies which are themselves preferred over unsystematic clinical observation or clinical reports. For questions concerning etiology, prognosis or harm generally the most appropriate study designs are observational studies were outcomes are compared between groups exposed and unexposed to risk and prognostic factors of interest. For questions dealing with diagnostic test the preferred study designs are cross sectional studies. In this type of studies the diagnostic test in question is compared to a reference standard.

Evidences can be searched for in textbooks, scientific journals, and electronic databases. By conducting an efficient computerized search you can arrive swiftly at the best external evidence that would answer the question of interest. The search might result in a thousand of published articles about the subject of interest. This is called information overload. However, Information overloads can be managed by filtering the research key words. Example: “Are topical fluoride treatments effective in reducing caries in children?” MedLine Search: “children, topical fluoride, caries” - 1031 articles

There are three levels of information processing and types of evidences: a, Guidelines and Summaries; b, Pre-appraised research; c, Non pre-appraised research.

To be efficient in our search for the evidence it is a good strategy to start looking at higher levels of processed information; that is searching for guidelines, Meta-analysis, systematic reviews and critical summaries. Guidelines represent the highest level of current evidences that are processed from meticulous and rigorous scientific analysis of the available data about a subject to furbish clinical recommendations. Also, well designed critical clinical summaries, Meta-analysis and systematic reviews represent highest quality evidence relevant to a search question.

Appraise

In this step of the EBD process is focused on appraising the validity and reliability of the evidence. Important questions to ask at this point – What is the level of evidence used to come to the conclusion? Does this apply to my patient?

Critical appraisal is the process of carefully and systematically examining research to judge its trustworthiness, and its value and relevance in a particular context. It is aim to assess whether a reported piece of research is good enough to be used in decision making. The elements of appraisal are external and validity, reliability and consistency of the test, the probability of chance of error, magnitude and precision of the outcome, statistical and clinical significance and applicability of the evidence.

Evaluation (Assess)

The EBD process involves using the evidence in treatment planning. Based on the clinical expertise, and the patient’s needs and preferences, how strongly should recommend this to the patient? The final step involves assessing treatment outcomes for the patient. The EBD process is assessing how well the previous steps worked and assessing the results and involves assessing treatment outcomes for the patient. Assess your performance, in the frequency of performing the whole process. And in the efficiency of performing each step. This understands what impact the treatment has had on your patients. Did it work? If not, why.

Types of sources and resources for the search question of interest

Primary sources is the stuff of most dental research publications and includes things like clinical trials, epidemiological studies, laboratory testing of new materials, genetic and biological testing. Primary research is the most often quantitative. Here the results of scientific enquiries are presented in numerical form, qualitative research where researchers analyses soft data, e.g. interviews or questionnaires, and explore themes and ideas that numbers often cannot describe meaningfully.

Secondary sources involve examining the results of previous research studies and analyzing this information to clarify a particular question. Examples include systematic reviews of literature or developing clinical guidelines.

Armed with the above picture that consists of the question of interest, its PICO elements and study design that would provide and furbish the best evidence, answers and needed scientific information, how can we use these in our search? Which resources can we use in quest for the evidence?

A variety of resources are available for free and available for the public. However, the full text for most of the systematic reviews and Meta-analysis or recent journal articles is not available for the nonsubscribers. Some EBD resources provide access to the evidence at all levels of evidence power; resources like: American Dental Association Center for Evidence Based Dentistry

(http://ebd.ada.org); Trip (www.tripdatabase.com); SUM Search (http://sumseach.org); Epistemonikos (www.epistemonikos.org). Resources that provide clinical recommendation: National Guideline Clearing House (www.guideline.gov).

Other EBD resources provide access to pre-appraised studies and reviews like: Journal of Evidence Based Dentistry (www.nature.com/ebd); Journal of Evidence Based Dental Practice (www.journals.elsevier.com/Journal-of-evidence-based-dental-practice); Journal of American Dental Association Critical Summaries (www.ADA.com/critical); Cochrane Oral Health group is considered the most useful resource in finding systematic reviews relevant to dentistry and dental practice (http://www.ohg.cochrane.org/reviews). Another resource that would provide access to primary non pre-appraised studies: PubMed (www.ncbi.nlm.nih.gov/PubMed); Embase (www.elsevier.com/online-tools/em base); Cochrane Central Register of Controlled Trials (www.cochrane.org). Another two resources although do not have dental section per se, they show online summaries of topics relevant to dental practitioners; these are: Up-to-Date (www.uptodate.com); Dyna Med (www.dynamed.ebscohost.com). Most if not all of the above mentioned electronic databases allow filtering to search for specific dental topics and study designs.

Let say we have an important search question but the highest level of evidence is not provided yet; what we mean is that clinical recommendations, systematic reviews and Meta-analysis of the available literature concerning the subject of interest is not available at the time of quest and search. So what is the process to appraise and criticize the pertinent available primary and standalone randomized and observational studies? How can we determine the effectiveness, the efficiency, the efficacy and the validity of the results presented in these standalone primary studies? How can we grade the strength of the available scientific data and identify the weaknesses? The answer to the process of scientifically appraising and criticizing the available data is discussed in the following section.

The usefulness of EBD [12-13-14].

1. Improve the effective use of research evidence in clinical practice.
2. Treatments & diagnostic test are being used at a time when their effectiveness is approved.
3. EBD prevents using ineffective treatment methods, so it will probably decrease charges.
4. It helps us updating our knowledge continuously instead of reading lots of irrelevancy & unreliable literature, so time saving.
5. It helps policy makers through development of clinical guidelines', providing them with enough documents & evidence. Monitor and develop clinical performance.
6. Instead of teaching students current standard treatment method, it teaches them how to find the best current therapy for their disease.
7. EBM promotes evidence instead of person's authority.
8. It decreases medical errors.

What are the limitations of EBD? [12-13-14-15]

1. First, the need to develop new skills in searching and critical appraisal can be daunting, although (as we pointed out above) evidence-based care can still be applied if only the former has been mastered and directed toward pre-appraised resources.
2. Second, busy clinicians have limited time to master and apply these new skills, and the resources required for instant access to evidence are often woefully inadequate in clinical setting

From current study it can be concluded:

1. Clinicians need to continually update on treatment options modalities and rationale as new research emerges.
2. By following a systematic approach, evidence can be considered and applied to clinical practice. This approach is standardized and repeatable, and facilitates the practice of evidence – based dentistry.
3. The application of evidence is essential in modern dentistry, and this approach is the core of the evolution towards evidence - driven practice.

Conflict of interest

The authors declare that they have no conflict of interests.

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