What is Evidence-based Dentistry?

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• Abstract

In our daily practice, we think about the diagnosis of our patient and get into a situation wherein we have to make a clinical decision. Diagnosis and treatment come from the knowledge and experiences that each dentist should have, but sometimes, we can have doubts on our decisions. “On what evidence did I make such decision? Was that really right?”

Drawing our attention these days as a possible answer to this question, evidence-based dentistry seeks to apply the best available evidence gained from the scientific method to medical decision making. To make a good decision, the strength of evidence is assessed. Specifically, randomized controlled trial, systematic review, and meta-analysis are considered the highest level of evidence; cohort study, case control study, case series, animal study, bench test, and biological plausibility follow.

With the approach of evidence-based dentistry, we can make objective, scientifically sound clinical decisions. It is also patient-oriented, incorporating clinical experiences and stressing good judgments; thorough and comprehensive, it uses transparent methodology. That is the reason evidence-based dentistry can be better than other assessment methods when we make a clinical decision in modern dentistry.

Evidence-based dentistry, decision making, strength of evidence

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I. Introduction

Advancement in the science of dentistry has been made at such rapid pace that referring to the current era as our trade's Golden Age compared to the previous ones is hardly an overstatement. Today, we are using implant placement -- a representative technology used to help recover lost teeth -- as well as other various tissue engineering techniques that were unprecedented in the previous generations. We are also enjoying revolutionary advancements in the various materials available in dentistry. No doubt, these new technologies and materials have opened the doors to exploration in our field new territories that go beyond the previous levels of dental technologies and theories. Nonetheless, as practitioners with years of clinical experience, we should pay attention to the unmistakably obvious fact that there are relatively few methods and materials that have survived the long period of field application and have emerged as the favored tools of clinicians today. Granted, a dentist cannot help but ask himself the question: "How can a dentist select and use the so-called wonder techniques or materials to ensure that he has made a wise decision?" Or, more relevant to our practice, "How many of the techniques we use on a daily basis are actually scientific and rational?"

As we are all aware, the present era in which we live and work is inundated with information, making us confused and exhausted at times with the sheer volume of information available. One of the most celebrated scientists of our time, Albert Einstein, also spoke of this dilemma: "The biggest scientific talent I have is that there is no error in any of the experiments and papers I've become associated with, that I know how to draw a small number of the most essential data and ignore the rest, and that I build a new theory based on only the good stuff[1]."

Whether or not to endow some degree of reliability to each and every paper or data set one comes across is addressed in evidence-based dentistry (EBD). EBD refers to decision making by dental clinicians based on the most scientific and reliable data available to them at present. To make the most well-informed decisions, one needs evidence upon which one bases one's decision. Thus, one's understanding of research -- which serves as foolproof evidence -- can significantly affect one's rational and scientific decision making.

This study sought to review the background of EBD and the characteristics of each level in the hierarchy of EBD research to help dental practitioners form objective ideas as to the level of studies they conduct. Ultimately, this study aimed at helping dentists cultivate objective and rational therapeutic perspectives and expand their professional competency by going beyond their personal, unsubstantiated clinical experiences and impressions.

II. Main Issue

1. Definition and historical background[2]

Evidence-based dentistry (EBD) traces its roots to evidence-based medicine (EBM), which can be defined as "medical practice that focuses on the physicians' informed selection and use of the best possible evidence there is when making decisions concerning the treatment of patients." Despite EBM's plain, common-sense advocacy of applying scientific principles in treating patients, the approach is said to have been initiated by scholars at Canada's McMaster University (David Sacket and Gordon Guyatt) only in the late 1980s. The term "evidence-based" was first used by David Eddy in 1990; the expression "evidence-based medicine" was first found in the paper by Guyatt, et al as recently as in 1992.

One reason EBD was introduced to the field and has since been accepted so widely is the global community's increased access to scientific publications, information, and data that can be obtained through the Internet, e.g., www.pubmed.org. In other words, the latest information and data are no longer the exclusive property of the selected few; they are available to anyone who seeks them, on a real-time basis, 24/7/365.

2. Understanding EBD[3]

In the past, dentists relied more on their intuition and clinical experiences (though unsubstantiated) as well as the conventional approaches when treating patients and making clinical decisions. Compared to these traditional methods, EBD is undoubtedly on the more cutting-edge side of the practice based on the best possible evidence available within the dental community. Nevertheless, it should not be used against all the other traditional

methods that dentists have been using for decades. In other words, the latest scientific information and data that are more readily available can best be used in conjunction with dental practitioners' accumulated clinical experience and individual patient cases and demands. EBD should be viewed as an auxiliary means of pursuing greater truth in the science of dentistry, not the panacea to all problems (Fig. 1).

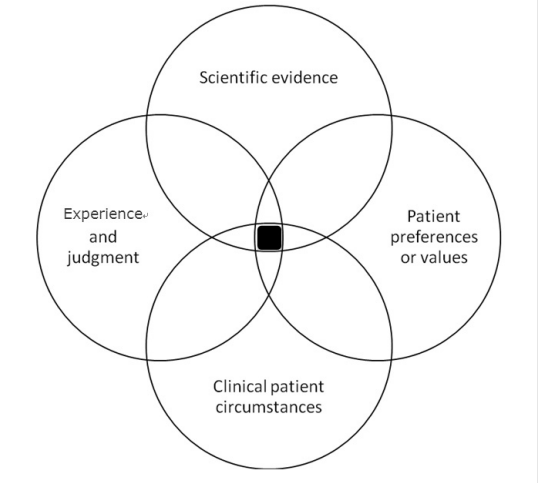

Fig. 1. Evidence-Based Decision Making.

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3. PICO question[4]

One smart way to implement EBD in actual dental settings is to ask PICO questions. Short for patient problem or population (**P**), intervention (**I**), comparison (**C**), and outcome or outcomes (**O**), PICO constitutes concise yet highly relevant questions to our dental practice.

For instance, a patient in her 40s visits your clinic. She appears to be healthy, with no particular medical history either physically or mentally but complains mainly of the discomfort she experiences during mastication in her upper left first molar (#26). Thus, you go ahead with tests; based on the results, you assess her condition and establish a treatment plan. In your assessment, the discomfort in question started sometime after she received nerve treatment, and it has persisted since then. The radiology tests revealed increased radiolucent activities around the dental root as well as symptoms suggestive of vertical root fracture. You conclude that tooth extraction is unavoidable. Since the patient requested for implant treatment, you may wonder whether to perform extraction followed immediately by implant placement or to pull out the tooth and wait for some time before carrying out the placement. These questions pop into your mind as you make specific treatment-related decisions.

In such a scenario, you might want to turn to PICO questions:

P (patient): A patient requires upper left 1st molar extraction and shows apical lesion.

I (intervention): Carry out immediate implantation?

C (comparison): Or perform delayed implantation?

O (outcome): What will be the difference between the implantation success rates? What about the differences in treatment difficulty and benefits for the patient?

Combining the four sets of questions, you may end up with the following: "A patient suffering from a lesion in one of her upper molars requires tooth extraction followed by implantation. The tooth in question exhibits apical lesion. Compared to delayed implantation, what will be the success rate of immediate implantation? What will be the differences between the two approaches in terms of treatment difficulty?"

Next, based on your questions, you log on to www.pubmed.org, search the related information from the site using the keywords "upper molar," "immediate implantation," "delayed implantation," and "implant success rate," and find the answers you have been looking for.

4. Sources of evidence and evidence hierarchy[3,4]

In EBD, evidence is categorized into "primary source" and "secondary source." The former refers to papers in their original state without editing or processing, whereas the latter means information/data that is recreated by editing or manipulating the primary source. Examples of secondary source include systematic review, meta-analysis, and clinical practice guideline/protocol.

Evidence is also classified into several "levels." In everyday situations, courts are perhaps the place where arguments based on "evidence" are heard most frequently. Criminal cases in particular exemplify how much power evidence wields in legal proceedings as the prosecutor and

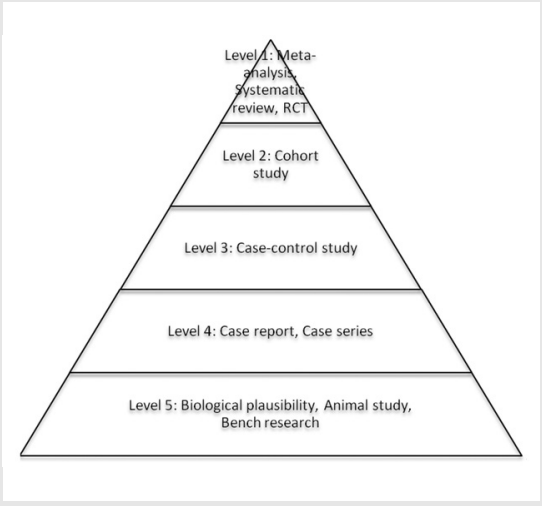

Fig. 2. Evidence Hierarchy.

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defense attorney battle fiercely in court using evidentiary support -- some of which are decisive, and some, only minor. Similarly, evidence in EBD is the deciding factor in determining the hierarchy of reliability levels, which is called "evidence hierarchy" or "evidence pyramid" (Fig. 2)

Level 5 as shown in Figure 2 refers to biological plausibility, animal study, and bench test. Biological plausibility means the dental professionals' plausible assumptions of a phenomenon based on physiological ground. No matter how plausible they may be, they are nothing more than assumptions without hard evidence. Thus, the degree of their importance as evidence is relatively low. Note that there are a surprisingly large number of assumptions that people had made based on common sense but later prove the contrary. With the bench test, applying the results obtained from animal and lab testing directly to your patients could be problematic. By all means, humans are different from lab animals and dummies. With Level 4 (case report/case series), case reports are anecdotal evidence that is unverified and transient at best. The term "case report" itself implies an unexpected, unusual or novel occurrence that one comes across so rarely in one's dental practice that one decides to share it with one's colleagues. In other words, anecdotal information is in most cases not the kind of information that was carefully planned and observed to figure out causal relationships. Ironically enough, present-day dentistry endorses seminars that offer mostly case reports or case series.

The inherent problem of case reporting, i.e., the reason its evidentiary reliability is relatively low, is often described with terms such as "cherry picking," "file drawer effect," and "publication bias." Cherry picking, for example, literally comes from the act of picking a cherry wherein the picker obviously intends to claim the ripest and the freshest fruit among the ones he/she sees. Similarly, the researcher doing the case report is likely to pick and choose the "good" information that supports his/her ideas and ignore the others that contradict his/her assumptions. The risk of distorting the truth is extremely high in case reporting.

The file drawer effect (problem) and publication bias (selective publication) are concepts similar to cherry picking. In general, researchers bury the data that are contrary to their assumptions in the file drawer and let them fade into oblivion. Journal publishers and editors, too, tend to favor sensational, positive results over negative ones. As John Ioannidis put it, negative papers are being persecuted[5]. In fact, Hasenboehler analyzed 12 major journal articles in general surgery and orthopedic surgery – which were published for 6 years starting from 2000 until 2006 -- and found that 74% of the papers reported some kind of "positive" results versus a mere 17% of the articles that reported "negative" findings[6,7]. This problem tends to worsen particularly when a study is funded by corporate dollars. To help overcome the problem, editors of some of the world's most prestigious medical journals such as the "New England Journal of Medicine," "The Lancet," "Annals of Internal Medicine," and "JAMA" declared in September 2004 that they will no longer publish pharmacological papers sponsored by drug makers unless they are registered with the boards prior to the commencement of the research.

Level 3 in the pyramid is case control study, which examines the results of an incident only retrospectively. With this type of research, establishing a causal relationship is more difficult than with a prospective study; hence its somewhat low evidence-related status. Nonetheless, case control study is a viable option in certain cases that are by nature cannot be studied via prospective approach in actual dental settings. For instance, rare diseases have a significantly low morbidity rate; thus, they require a tremendous amount of samples for researchers to conduct a prospective study and to test the statistical significance. Securing such large samples is unlikely due to time and cost

constraints, however. As such, researchers have no choice but to resort to case control studies.

Level 2, cohort study, refers to prospective study. To prevent confusion between case control study and cohort study, think of a research project that will look into the correlation between temporomandibular disorders (TMD) and malocclusion. If one is to launch a case control study, which is a retrospective study, one will sample some hundreds of TMD sufferers and the equal or a similar number of those without TMD, examine how many in each group actually have malocclusion, and review the correlation between TMD and malocclusion. In contrast, a cohort study would select hundreds of individuals with malocclusion but not TMD (yet) and hundreds of those without malocclusion, continue to monitor the two groups over an extended period of time, examine in each group the number of participants who have developed TMD over the years, and test the correlation between TMD and malocclusion. Even to a layperson's mind, cohort study (prospective study) would appear to be much more difficult and accordingly claim a higher position in the evidence hierarchy. Nonetheless, cohort study is lower in terms of reliability because it is not randomized as in a randomized clinical trial (RCT).

Lastly, Level 1 – RCT, meta-analysis, and systematic review – boasts of the best possible way to overcome the bias: randomization. Meta-analysis involves collecting and analyzing a number of similar studies that will increase the sample size and power. In systematic review, researchers review and analyze the relevant papers in search of answers to particular question(s).

At present, systematic review is the golden standard and is at the top of the evidence hierarchy.

III. Discussion

With the dawning of the digital/Internet era, dental science, too, has been undergoing waves of transformation. The introduction of implant treatment in particular has undoubtedly changed among many clinicians their perspectives of dental science to a significant degree. New techniques have been continuously tried; clinicians' efforts to substantiate or contradict them have been continuing as well.

In fact, the field of dentistry had more or less been relying heavily on individual dentists' empirical experience or on dogmatic theories until implant technology was introduced to the field and the resulting aggressive academic endeavors started to unfold as in animal testing and case reporting.

Compared to the conventional approach in dentistry, EBD emphasizes objectivity, scientific and rational perspectives, client-centered practice, and clinical experience. It stresses optimal decision making and utilizes thorough, inclusive, and transparent methodologies. All these strengths make EBD a more beneficial evaluation method than other techniques when it comes to making decisions in clinical settings[8].

Demanding evidence is an emerging trend that is being recognized as the norm not only in dentistry but in many other disciplines as well. EBD is even being recognized as a fad, which compels us to address the issue that we need to think about, i.e., whether or not EBD is being represented accurately and is true to its nature. For instance, relying too much on EBD will likely lead to an error wherein the level of evidence (see the Evidence pyramid concept mentioned earlier) is overly emphasized. Although systematic review constitutes the highest level of evidence, the problem is the quality of the evidence. If the review is based on a few studies that lack thoroughness and details in design and show poor quality, the studies will not be better evidence than a single, well-designed case control study[9]. Moreover, the types of questions asked will require different types of evidence; sometimes, locating a higher level of evidence can be challenging. Take fatal drug dose studies for instance. For such studies, testing on human subjects is out of the question; thus, clinicians turn to animal testing instead. Not all cases require RCT after all[10].

IV. Conclusions and Recommendations

Evidence-based dentistry (EBD) is becoming a crucial guideline for dental practitioners of the 21st century. The trend is not only desirable; it is also expected to be accelerated in the future. To ensure that EBD takes root in the medical profession as a viable practice regimen, we need to strike a balance between three "role players." First are the creators of evidence. These primary evidence creators must produce rational, outstanding study designs and generate accurate, honest data for clinicians. Second are the collectors and distributors of evidence. These individuals

must be honest first and foremost because clinicians (end consumers) cannot afford to check personally every single piece of evidence there is when it comes to clinical information and data due to their hectic schedule and daily practice demands. End consumers tend to resort to seminars and other faster, easier ways of finding information and data. Thus, evidence collectors and distributors should offer clinicians non-contaminated data by processing and editing primary data into highly usable, consumer-friendly sets of information and data that are high-quality and reliable secondary sources of information. Third and last are the dental clinicians. They need to evaluate the evidence, apply it to individual patients, carefully monitor the results, and share what they have found with colleagues and report accordingly. In most cases, dentists are the end users of the evidence as well as the brokers and creators of such.

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