Evidence-based Dentistry: A Literature Review

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Abstract:

Over the past few decades there has been an exponential increase in the field of scientific research. Hence keeping up with the everchanging field is necessary but also requires investment of effort and time. Evidence based dentistry helps clinicians be updated with the current line of research and treatments hence helping them make an informed decision in order to deliver the best possible care to patients. Evidence-based decision making requires understanding new concepts and developing new skills including how to: ask good clinical questions, conduct a computerized search, critically appraise the evidence, apply the results in clinical practice, and evaluate the process. It aims to create a dialogue between dental practitioners and dental researchers, in order to drive new research and promote the use of best available evidence to inform clinical decision making.

Keywords: Evidence-based Dentistry, levels of evidence, steps of evidence-based dentistry

Introduction:

In the current era with the provision of authentic treatment along with the growing competition, clinicians are expected to keep up with the advancements in medical and dental practices. This includes being up par with the new methods, materials, latest research evidences and clinical recommendations. This process can be difficult to cope with however with rapidly evolving science and technology, information has become readily available for dentists to address these challenges and adopt an evidence-based approach in their clinical practice wherein they can formulate a treatment plan based on results of previously applied techniques and knowledge in order to deliver the right care to the right patient. This is commonly known as Evidence-Based Dentistry (EBD).

Evidence based dentistry was first introduced by Gordon Guyatt in the 1990s after the introduction of Evidence-Based Medicine (EBM).

David Sackett defined EBD as "Integrating individual clinical expertise with the best available external clinical evidence from systematic research."[1]

American Dental Association (ADA) defines Evidence Based Dentistry 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." [2]

Principles of EBD:

Evidence-Based Dentistry is characterized by the amalgamation of the following three elements:

1. Dentist's clinical expertise

The practice of EBD relies majorly on a dentist's ability to judge a clinical situation accurately and ask the right questions in order to look for the best available data and ultimately perform the required treatment with good clinical expertise. Azarpazhooh A et al. stated that evidence-based practice is a process of lifelong, self-directed learning in which providing health care creates the

need for important information about diagnosis, prognosis, treatment, and other clinical and health care issues. [3]

2. Best available scientific evidence

It is important that the decisions of clinical care are supported with the best available scientific evidence in order to maximize the potential for successful patient health care outcomes.

According to the ADA policy statement on EBD, the term best evidence refers to "information obtained from randomized controlled clinical trials, nonrandomized controlled clinical trials, cohort studies, case-control studies, crossover studies, cross-sectional studies, case studies or, in the absence of scientific evidence, the consensus opinion of experts in the appropriate fields of research or clinical practice. The strength of the evidence follows the order of the studies or opinions listed above." [4]

3. Patient's needs and preferences

This refers to the patient's concerns, expectations and their unique preferences. Not all patients have the same priorities for their care. Therefore, it is the duty of the clinician to understand the patient's individual needs and circumstances and discuss the treatment options available with them and integrate it in the diagnostic plan.

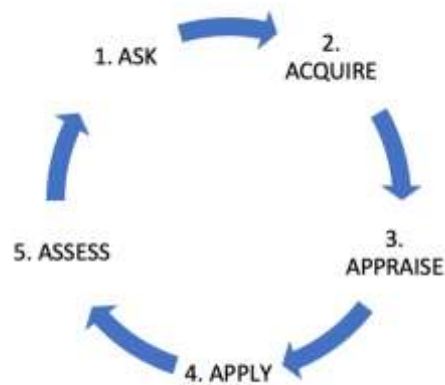**Steps of evidence-based dentistry** (image 1)

Image 1: Steps of Evidence-based Dentistry

1. Ask: Convert the need for clinical information into an answerable question
2. Acquire: Find and rank the best evidence with which to answer the question
3. Appraise: Critically appraise the evidence for validity, impact, and applicability
4. Apply: Integrate this evidence with clinical expertise and the patient's unique circumstances and preferences
5. Assess: Evaluate effectiveness and efficiency in executing steps 1 through 4 [5]

1. ASK

Converting the problems or the information needed into clinical questions so that they can be answered is the stepping stone of EBD. Sackett et al. suggested that a question can either be a background or a foreground question, depending on what type of information the dentist needs. [6]

Background questions: These are general knowledge questions which can be answered using traditional textbooks. The questions have two components wherein they start with who, what, where, when, why or how and a verb that connects them to the item of interest.

For example: "What is chronic periodontitis?"

Foreground questions: These are more precise and about the management of the patient and require specific knowledge as they are usually related to a specific clinical scenario.

For example: Will an occlusal splint reduce temporomandibular joint discomfort for an adult patient with sleep bruxism?

Pico model:

Foreground questions usually have four components, called the PICO model, which helps in formulating a well-built clinical question which assists the clinician in organizing and focusing the same into a search

- P = Patient, Problem, Population

- I = Intervention, Prognostic Factor, Exposure

- C = Comparison

- = Outcome

Some authors have also suggested inclusion of T and S:

- T = Timing, duration or date of publication
- S = Study type (e.g. randomized controlled trial, cohort study etc.) [7]

The use of PICO frames enhances the specificity and conceptual clarity of clinical problems, elicits more data during pre-search reference interviews and produces more accurate search results.[8]

Example:

Patient/ Population/ Problem- Adult patient with sleep bruxism

Intervention/ Exposure- Occlusal splint

Comparison- N/A

Outcome- Reduce jaw muscle discomfort

Therefore, the clinical question would be- In an adult patient with sleep bruxism, will an occlusal splint reduce jaw muscle discomfort?

2. ACQUIRE

Finding relevant evidence requires conducting a focused search of the peer reviewed professional literature supporting the suitable methodology. Online databases and software that enable quick access to the literature have made it easier to locate relevant clinical evidence.[9] Traditional sources of evidence include printed materials like textbooks, personal journal collections, conference proceedings, clinical guidelines, colleagues and personal experiences. Rules of evidence have been established to grade evidence according to its strength, giving rise to the concept of 'Hierarchy of Evidence.' The hierarchy provides a framework for rating evidence and indicates which study types should be given more weight when assessing the same question.[10]

Levels of evidence

It is a heuristic which is employed to rank the relative strength of the results that are obtained from scientific research (Image 2). In 2014, Stegenga defined a hierarchy of evidence as "rank-ordering of kinds of methods according to the potential for that method to suffer from systematic bias".[11]

According to the GRADE methodology, the study designs in medical research can be hierarchically grouped based on their level of evidence and their strength of recommendation of clinical interventions by the use of GRADE (Grading of Recommendations Assessment, Development And Evaluation) methodology.[12]
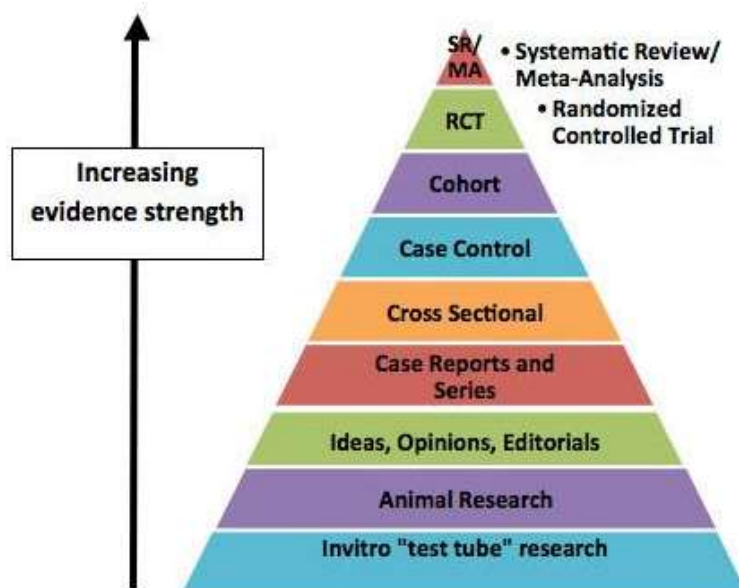
Image 2: Levels of evidence- As you advance up the pyramid, the quantity of studies and congruently the amount of available literature decreases, while at the same time their relevance to answering clinical questions increases.

3. APPRAISE

Once the necessary evidence is found, the next step in the EBDM process is to understand the evidence and its relevance to the patient and the PICO question. Critical appraisal can be used to quickly evaluate and dismiss research studies that are unimportant or of poor quality. This can be accomplished by using design-specific checklists with key markers of good research.

Critical appraisal allows us to:

- Reduce information overload by eliminating irrelevant or weak studies
- Identify the most relevant papers
- Distinguish evidence from opinion, assumptions, misreporting, and belief
- Assess the validity of the study
- Assess the usefulness and clinical applicability of the study
- Recognize any potential for bias

When appraising the evidence, the following three things need to be considered:

- Quality
- Validity: the ability to measure what is supposed to or is intended to be measured
- Reliability: the ability to measure what you want to measure on subsequent experiences

> **Phase 1: Rapid critical appraisal [13,14]**

The first phase of critical appraisal begins with determining which studies will be kept in the body of evidence. There should be inclusion of all relevant, reliable, and valid studies. This is done by using design-specific checklists that include key markers of good research.

Two tools are used in rapid critical evaluation, which aids researchers in deciding if a research study is valuable enough to be kept in the body of evidence.

The first tool is the General Appraisal Overview for All Studies (GAO) which covers the basics of all research studies. It is best to start with learning why the study was carried out and how it responds to the PICOT question in order to complete the GAO. If the study purpose helps answer the PICOT question, then the type of study design is evaluated which is compared with the hierarchy of evidence. The higher the design falls within the hierarchy or levels of evidence, the more accurate is the evidence.

Next, the sample size is evaluated. The more participants in a study, the more confidence in the findings when it comes to quantitative studies. Qualitative designs, however, operate best with smaller sample size because these designs represent

a deeper dive into the understanding or experience of each person in the study. The GAO's final stage is to take into account the analyses that respond to the study's research questions or support its hypotheses. An essential part of evaluating quantitative data critically is comprehending what the statistics say about the study findings.

The second tool is the appraisal checklist that speaks to validity, reliability, and applicability of specific study designs. The checklist should answer three key questions.

What are the study results?

Are the results of the study valid?

Are the results applicable to my patients?

Various organizations provide checklists to aid with quality appraisal:

a.   CASP (Critical Appraisal Skills Programme)

Provides checklists, e-learning, and workshops on critical appraisal.

b.   AMSTAR (A Measurement Tool to Assess Systematic Reviews)

Checklist An appraisal tool to evaluate systematic reviews.

c.   CONSORT (Consolidated Standards Of Reporting Trials)

The CONSORT Statement, an evidence-based minimal set of recommendations for reporting randomized trials (Table 1), is the primary output of the CONSORT Group. It offers a standard way for authors to prepare reports of trial findings, facilitating their complete and transparent reporting, reducing the influence of bias on their results, and aiding their critical appraisal and interpretation.[15]

Title and abstract	Identification as a RCT in the title- Structured summary (trial design, methods, results, and conclusions)
Introduction	- Scientific background - Objectives
Methods	-Description of trial design and important changes to methods -Eligibility criteria for participants -The interventions for each group -Completely defined and assessed primary and secondary outcome measures -How sample size was determined -Method used to generate the random allocation sequence -Mechanism used to implement the random allocation sequence -Blinding details -Statistical methods used
Results	-Numbers of participants, losses and exclusions after randomization -Results for each group and the estimated effect size and its precision (such as 95% confidence interval) -Results of any other subgroup analyses performed
Discussion	-Trial limitations -Generalizability
Other information	- Registration number

Table 1: Summary of guidelines for CONSORT [15]

➢ PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

It is an evidence-based minimum set of items (Table 2) aimed at helping authors to report a wide array of systematic reviews and meta-analyses that assess the benefits and harms of a health care intervention. PRISMA mainly focuses on systematic reviews and meta-analysis of randomized trials.

Title	Identification of the report as a systematic review, meta-analysis, or both.
Abstract	Structured Summary: background; objectives; eligibility criteria; results; limitations; conclusions; systematic review registration number.
Introduction	-Description of the rationale for the review -Provision of a defined statement of questions being concentrated on with regard to participants, interventions, comparisons, outcomes, and study design (PICOS).
Methods	-Specification of study eligibility criteria -Description of all information sources -Presentation of full electronic search strategy -State the process for selecting studies -Description of the method of data extraction from reports and methods used for assessing risk of bias of individual studies in addition to methods of handling data and combining results of studies.
Results	Provision of full details of: -Study selection. -Study characteristics (e.g., study size, PICOS, follow-up period) -Risk of bias within studies. -Results of each meta-analysis done, including confidence intervals and measures of consistency. -Methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression).
Discussion	-Summary of the main findings including the strength of evidence for each main outcome. -Discussion of limitations at study and outcome level. -Provision of a general concluded interpretation of the results in the context of other evidence.
Funding	Source and role of funders.

Table 2: Summary of PRISMA guidelines [14]

Once the final group of keeper studies is identified, clinicians are ready to move into the next phase of critical appraisal.

➢ **Phase 2: Evaluation**

In this phase, the keeper studies are put together in a table so that they can be compared as a body of evidence, rather than individual studies. The goal is to determine how studies within the body of evidence agree or disagree by identifying common patterns of information across studies. For instance, a reviewer might compare whether the same intervention is employed or whether the results are measured uniformly across all studies. An evaluation table is a helpful tool that clinicians can utilize to accomplish this. The in-depth understanding of the body of evidence from the evaluation table helps with discussing the relevant

clinical issue to facilitate the best practice. The patterns and in-depth understanding are what lead to the synthesis phase of critical appraisal.

➢ Phase 3: Synthesis

In the synthesis phase, clinicians pull out key information from the evaluation table to produce a snapshot of the body of evidence. A table is used here to feature what is known and help all those viewing the synthesis table to come to the same conclusion. There are at least two recommended evidence synthesis tables, the level-of-evidence table and the impact-on-outcomes table for quantitative questions. These tables are the foundation that supports clinically meaningful recommendations.

➢ Phase 4: Recommendation

Recommendations are definitive statements that are based on what is known from the body of evidence and indicate what should be done or what is thought to be the best practice. For instance, when considering an intervention question, clinicians should be able to determine from the data whether delivering the intervention as it did in the trials will dependably result in the intended outcome.

4. APPLY

The information obtained from assessing the evidence should then be considered in relation to the question that prompted the dentist to undertake the search. This step promotes the application of explicitly evaluated evidence to specific patients' needs and local conditions while taking into consideration patient preferences and local or personal characteristics.

5. ASSESS

There are numerous ways EBDM can be incorporated into practical clinical situations. Using the EB process, clinicians and students can be current with practice guidelines, statements and policies, support clinical decisions, answer patient questions, and explore alternative treatments, procedures or materials.

Barriers of evidence-based dentistry:

1. The Information Overflow Barrier [17]

One of the main concerns clinicians have is the challenge of keeping up with a constantly expanding knowledge base. It is inconceivable for private practitioners to even consider analyzing this overwhelming volume of research. Therefore, most rely on systematic reviews. Unfortunately, the number of systematic reviews that address clinical topics in dentistry is small, but it is growing. An additional problem with systematic reviews is their inability to inform practitioners about new dental materials and techniques. Further complicating this situation are savvy sales representatives who often provide slick marketing pieces with questionable claims. In the absence of reliable systematic reviews and scientifically sound data, clinicians are forced to depend on either clinical trial and error or commercial market information.

2. Guideline or Treatment Algorithm Barrier [17]

Clinicians also question whether these systematic reviews can lead to conclusions that will result in clinical practice guidelines. Studies have shown that there are several impediments, such as unawareness of the existence of guidelines, personal disagreement with the guidelines, lack of confidence in expected results.

3. Patient-Related Barrier [17]

Patient preferences can be a barrier to adherence to evidence-based care. Patient decisions about care are based on 2 major factors: personal desire and insurance benefits. With increased dental advertising and ready access to information on the Internet, today's patients are well-informed consumers making it difficult for clinicians to provide evidence-based care.

4. Internal and External Barriers Faced by Clinicians [17]

Internal barriers that may prevent adoption of EBD are that clinicians may fall prey to practice inertia and not be motivated to change. Altering therapeutic regimens in a small practice may require behavioral adaptations among the staff. It has been noted that clinicians still practice in the same fashion as they were taught in their earlier

training which is inappropriate given the rate of change in clinical dentistry and availability of continuing education courses.

External factors not under the clinician's control also impact EBD. For example, necessary access to certain equipment or changes in facility design may be cost-prohibitive, making adherence to certain aspects of EBD difficult. Other barriers include insufficient staff support, poor reimbursement, escalating practice operational costs, and increased liability.

Conclusion:

Evidence based dentistry helps clinicians make an informed decision but it by itself does not give definitive answers. It relies majorly on the clinical expertise and how a dentist is able to identify and correlate the correct available knowledge with the given patient at hand. Use of systematic reviews and randomized controlled trials to find evidence addressing the clinical problem helps the practitioner to come up with a suitable treatment plan for that patient. Also, in the light of ongoing new researches, knowledge can deteriorate with time for the healthcare providers. Thus, EBDM provides a mechanism for addressing these gaps in knowledge in order to provide the best care possible.However, the translation of scientific information into daily practice and dental education has been slow. With the help of developing technology, dentists can easily access the evidence needed. Evidence based practice should also be incorporated in the curriculum therefore helping the students get accustomed to it at an early age which will eventually help them keep up with the upcoming technologies in the ever-changing field of dentistry.

Conflict of interest:

There are no conflicts of interest.

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