

White Paper

Critical Thinking and Evidence-Based Clinical Decision-Making: Required Skill-Sets in Dentistry

CRITICAL THINKING AND EVIDENCE-BASED CLINICAL DECISION-MAKING: REQUIRED SKILL-SETS IN DENTISTRY

Satheesh Elangovan, BDS, DSc, DMSc & Michael G. Newman, DDS, FACD

Together, basic knowledge, evidence-enhanced and well-informed clinical decision-making have the best chance of improving patient outcomes. There are thousands of articles published in dentistry each year but despite the plethora of data, there is limited evidence for many day-to-day clinical questions. This situation calls for ‘critical thinking’ (CT) and ‘problem solving’ skill-sets in dental students and practicing clinicians.¹ In line with this existing need, CT is now considered by the Commission on Dental Accreditation (the dental accreditation body in the U.S.) as an important proficiency that dental graduates must be competent in before they can become independent clinicians.

Newman and Carranza’s *Clinical Periodontology 13th edition* textbook,² and its online content is a comprehensive reference, teaching, and learning resource for students, educators, and practicing clinicians. It is the first major textbook and reference in periodontology to contain specific chapters on clinical significance, evidence-based dentistry (EBD) and CT. *Figure 1*

Methods to Enhance CT and Evidence Based-Clinical Decision-Making (EBCDM)

For students who are currently in dental and post-doctoral training programs, helping them understand the basics tools of EBD is fundamental. In addition, integrating CT and EBCDM lectures with other educational formats that simulate real-life clinical scenarios, (like small group case-based learning sessions) provides an ideal platform for students to hone their EBD competency. For this system to be effective, it is important that faculty members moderating these sessions are well-trained in the EBCDM process and the various appraisal tools available to evaluate student progress.

Identifying and eliminating unwanted redundancies in basic and clinical courses will facilitate decompression of the currently packed dental curriculum and provide space for implementing CT and problem-solving exercises. Examples of such exercises are: case-based scenario analysis, debates, problem-solving, argument mapping, role-play, thinking aloud, and others (if they are not already integrated in the curriculum structure).^{3,4}

Evaluation of CT and EBCDM

Following are some ways by which CT can be assessed:

- Creating interactive treatment-planning exercises for a variety of carefully selected case scenarios and evaluating the students’ ability to come up with a search question, identify the existing relevant scientific evidence, appraise the quality of evidence, and use CT and logical reasoning to apply to the case in hand.

Figure 1

Defining Four Levels of Clinical Significance

Based on the nature of the benefit (tangible/intangible) and the size of the treatment effect (large/small), four levels of clinical significance can be defined (Table 31.1). In order of decreasing levels of significance, these are numbered from 1 to 4.

TABLE 31.1 Definition of Levels of Significance Based on Size and Nature of the Benefit

SIZE OF THE BENEFIT			
Clinical Significance		Large ^c	Small ^d
Nature of the Benefit	Tangible ^a	Level 1	Level 2
	Intangible ^b	Level 3	Level 4

Clinical Significance Level 1

Treatments of clinical significance level 1 are the “magic bullets” or “miracle cures,” in which the treatment provides a tangible benefit and a large treatment effect. Examples include the use of vitamin C to treat scurvy, bone marrow transplantation to treat leukemia, and a very-low-carbohydrate diet to prevent all forms of dental decay. In all three examples, the benefits of the treatment are tangible and the size of the treatment effect is large.

Understanding the biologic mechanisms of a treatment is not required to establish that the treatment has clinical significance level 1. Lemon juice was identified as an effective method to prevent scurvy in 1601, but it was not until the beginning of the 20th century that vitamin C was isolated.²⁵ The dangers of carbohydrates in dental decay were recognized millennia before potential mechanisms of action were understood. Digitalis was discovered as a treatment for “dropsy” long before physicians became aware of the drug’s cardiac effects.²⁶ Lithium is an effective drug for bipolar disorder, but its mechanism of action remains largely unknown.²⁷ In contrast, hormone replacement therapy (HRT), for which the biologic mechanisms explaining how the drug provided benefits were supposedly so well understood, resulted in more harm than good.¹²

Key Fact

The size of the anticipated treatment effect has a profound impact on the planning of randomized clinical trials. The smaller the treatment effect, the larger the number of patients who will need to be recruited.

- CT of students can also be assessed in clinical exams that are in objective structured clinical examination (OSCE) format. In addition to evaluating clinical skills, incorporating case-based scenarios in dental licensure exams can be a good summative evaluation of CT in dental graduates, prior to practice. This approach also incorporates new case-based interactive questions like the upcoming integrated National Board Dental Examination format. These cases are great opportunities to apply basic knowledge and CT skills to better understand the complexity of real clinical cases. *Figure 2*
- Other than the aforementioned strategies, specific skill tests are available to evaluate CT in students. California CT Skills Test and the Health Sciences Reasoning Test (HSRT) are some examples.⁵ A recently published study validated the effectiveness of HSRT in dentistry in delineating expert critical thinkers from the novice cohort.⁶

Accessing and Assessing Current Information

Integrating EBD search engines and applications in the electronic health record is a practical strategy to facilitate the application of EBD in day-to-day clinical practice. This integration of medical and dental health records will allow clinicians to thoroughly access the patient’s oral and medical status. At the same time, these systems can simultaneously apply EBD evaluation of current information helping the clinician provide the most appropriate care. A good example of its value is the screening and identification of medication(s) usage by patients before prescribing any new medications to avoid any potential adverse drug interactions, which can be life saving for some patients.

It is of course important for practicing clinicians to be life-long learners and to become familiar with the constantly evolving scientific evidence and on the evolving concepts of EBD on a frequent basis. Making EBD updates in the form of continuing education courses (at specific intervals) mandatory for licensure renewal is one approach to enhance clinicians’ awareness and adherence to evidence-based clinical decision-making.

References:

1. Elangovan S, Guzman-Armstrong S, Marshall TA, Johnsen DC. Clinical decision making in the era of evidence-based dentistry. *J Am Dent Assoc.* 2018 Sep;149(9):745-747. doi: 10.1016/j.adaj.2018.06.001.
2. Newman MG, Takei H, Klokkevold PR, Carranza FA. Newman and Carranza’s Clinical Periodontology, 13th Edition. 2018, Elsevier, PA.
3. American Dental Education Association. <https://www.adea.org/adeacci/Resources/Critical-Thinking-Skills-Toolkit/Pages/Overview-of-Critical-Thinking-Skills.aspx>. Assessed September 9th 2018.
4. Elangovan S, Venugopalan SR, Srinivasan S, Karimbux NY, Weistroffer P, Allareddy V. Integration of Basic-Clinical Sciences, PBL, CBL, and IPE in U.S. Dental Schools’ Curricula and a Proposed Integrated Curriculum Model for the Future. *J Dent Educ.* 2016 Mar;80(3):281-90.
5. American Dental Education Association. <https://www.adea.org/adeacci/Resources/Critical-Thinking-Skills-Toolkit/Pages/CTS-Tools-for-Assessment.aspx>. Assessed September 9th 2018.
6. Hanlon JP, Prihoda TJ, Verrett RG, Jones JD, Haney SJ, Hendricson WD. CT in Dental Students and Experienced Practitioners Assessed by the Health Sciences Reasoning Test. *J Dent Educ.* 2018 Sep;82(9):916-920. doi: 10.21815/JDE.018.089.

Figure 2

Case Scenario 34.1

Patient:
55-year-old male

Chief Complaint:
"I have bad breath, and my gums bleed when I brush."

Background Information
Patient has type 2 diabetes (last HbA1c level was 8) and is a past smoker. Patient takes oral hypoglycemic medication for diabetes and denies any allergies. His last dental cleaning was done 4 years ago, and he denies flossing and reports brushing once a day.

Current Findings:
Probing depths were in the range of 2 to 7mm, bleeding on probing was 47% and poor oral hygiene.

CASE-BASED QUESTIONS	SOLUTION AND EXPLANATION
1. What is the major risk factor for periodontal disease in this clinical scenario? A. Extensive restorations B. Uncontrolled diabetes C. Medication usage D. Current smoking	Show Solution
2. What is the effect of controlling diabetes on periodontal treatment outcome? A. Improves the outcome B. Does not change the outcome C. Worsens the outcome	Show Solution
3. In patients with diabetes (well controlled with	Show Solution