

The Translational Clinical Practice System: A Way to Implement the Evidence-based Approach in the Dental Office

George K. Merijohn, DDS, and Michael G. Newman, DDS

ABSTRACT

Evidence-based decision-making in dental practice is challenging and rewarding. But for many clinicians, the evidence-based approach is an abstract and even theoretical idea that sounds good, but is not very practical. The Translational Clinical Practice System provides an overriding domain and a system within which the evidence-based approach may be more effectively utilized in clinical practice. Most would agree that using good evidence, information, and data as the basis for decisions are the starting points toward reaching the best results for the patient. However, there are clearly insufficiencies in the currently available best scientific evidence for many of the procedures patients need. The good news is that the evidence environment is improving and better quality information is becoming available in the office where it is needed. This article describes a logical and straightforward approach for clinicians to use in order to put together complex and often interwoven factors involved with patient care. Specific clinical examples are provided.

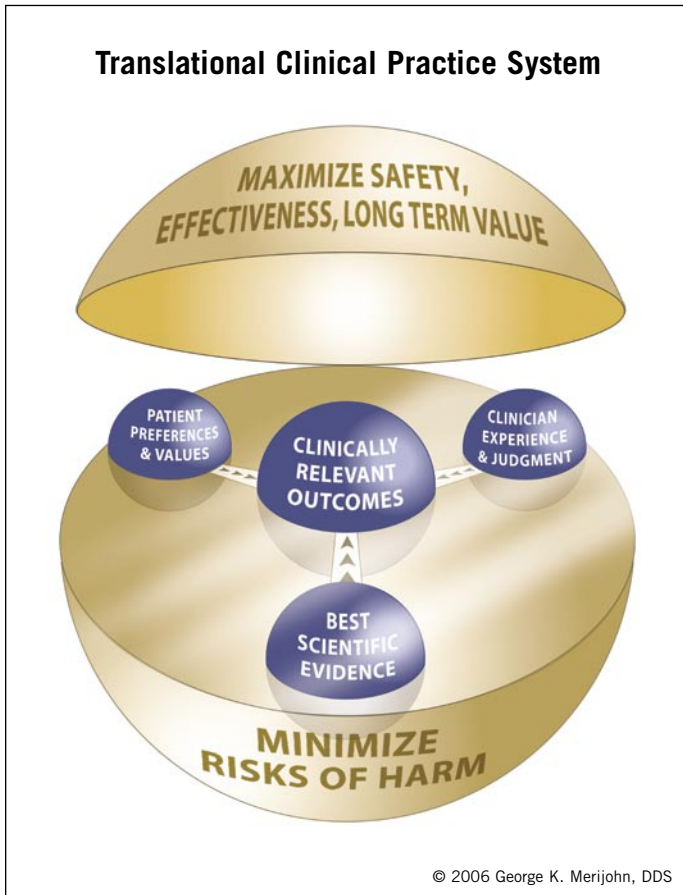
Four years ago, the National Institutes of Health determined there was a definitive need to translate the remarkable scientific innovations being witnessed into usable information by the clinician, and thus into improved health gains for the nation. The question asked was “What novel approaches can be developed that have the potential to be truly transforming for human health?” This query led to the development of the NIH Roadmap for Medical Research.¹ This initiative encourages fundamental changes in research, as well as in education. Among many initiatives, the roadmap wants to accelerate advances in the understanding of biologic systems and it wants to integrate powerful new tools that can be used at both the bench and



Authors/George K. Merijohn, DDS, is a periodontist in private practice since 1981. He taught periodontics at the University of

California San Francisco and at the University of the Pacific. He is author of *Perio Access Clinical Decision Making and Record Keeping System*, and continues to teach via journal publications, lecturing, and facilitating TCPS-based Dental Interactive Learning Groups.

Michael G. Newman, DDS, is an adjunct professor of periodontics at the University of California Los Angeles School of Dentistry, editor and chief of the *Journal of Evidence-Based Dental Practice*. A periodontist since 1974, he has practiced in Los Angeles and Beverly Hills, and is a past president of the American Academy of Periodontology, and a diplomate of the American Board of Periodontology.



© 2006 George K. Merijohn, DDS



Reference: *The Journal of Evidence-Based Dental Practice*

© 2006 George K. Merijohn, DDS

Diagram A. The large sphere in **Diagram A** represents the context which overrides clinical decision-making. The key to the TCPS approach is to recognize that there is a balance between maximizing safety, effectiveness and value and minimizing risk of harm. The four basic fundamentals of evidence-based decision-making are represented by the interconnected spheres. Clinicians should seek the highest level available in each sphere. The weighted emphasis of each sphere will vary depending upon individual circumstances.

Diagram B. Levels of Evidence Used to Determine Validity and Applicability of Clinical Research

The levels provide a better understanding of the quality and strength of the study and are based on the studies ability to control for bias and to demonstrate cause and effect.

the bedside in order to shorten the traditionally long lag time between discovery and clinical use. Genomics, proteomics, transgenic animal models, structural biology, biochemistry, and imaging technologies offer unprecedented prospects for advancing knowledge of human disorders in a translational context.²

The NIH is also encouraging fundamental change in how we train the new generation of clinicians for the health care challenges of this century. Its aim is to stimulate the development of a brighter vision through innovation and experimentation. It encourages a multiplicity of transformational tactics, since it is clear that no one model can be successful in all health care environments.

The Translational Clinical Practice System

The objective of the Translational Clinical Practice System Model is to lower the barriers to complex clinical decision-making in order to improve patient care. It provides a logical and straightforward way of putting together all of the complex and often interwoven decision components involved with patient care. The TCPS is designed to facilitate the clinicians' skills in translating the multifaceted interrelationship of scientific evidence, patient preferences and values, clinician experience and judgment, clinically relevant outcomes and ethical practice parameters into substantial health care improvements for their patients (**Diagram A**). The TCPS challenges con-

ventional thought by encouraging a fundamental change or transformation in how clinicians decide upon treatment.

The focus of this article is to introduce the reader to the TCPS and to illustrate its use as an innovative vehicle with which to implement the evidence-based approach in clinical practice. It is written in the first-person narrative, because it describes our own experiences and views. As will be illustrated, implementation of the TCPS approach by the clinician is not dependent upon bureaucratic legislation or mandates. It just requires understanding of a few fundamental beliefs that put the patient's welfare at the foremost front of our clinical decision-making. Although

many of the examples used here are periodontal, the concept is applicable to all aspects of dental clinical practice.

The Evidence-based Approach

The movement toward actively incorporating evidence-based decision-making in dental practice is exciting and enriching. It is also challenging. For example, with a given clinical question, what is the clinician to do when there exists only flawed evidence or no evidence at all?

Evidence-based practice has been defined as combining best research evidence, along with clinical experience and patient preferences to improve treatment outcomes.³ However, a large amount of published scientific research provides inadequate information, and that lack of good data significantly impairs the clinicians ability to translate these resources as high-level evidence when advising patients and providing treatment (**Diagram B**).

Fletcher and Sackett described "levels of evidence" to rank the validity of research evidence and then correlate these levels to different grades of recommendations.⁴ These evidence levels have evolved over the years and have found their way into mainstream dental literature. For example, *The Journal of Evidence-Based Dental Practice* uses a modification of the levels of evidence developed by the Centre for Evidence-based Medicine at Oxford University, a portion of which is depicted in **Table 1** and graphically represented in **Diagram B**.⁵

The levels (grades) give the reader a better understanding of the quality and strength of the study. The grades are based on the studies' ability to control for bias and to demonstrate cause and effect. Although each level of evidence contributes to our body of knowledge, it behooves the clinician to always utilize the best available evidence for each clinical question. However, not all clinical questions can be answered by the gold standard (level 1a) of evidence: the systematic review of high quality, randomized controlled trials.

Ethical Practice Parameters

Because of the scarceness of high-level scientific evidence and the complexity of many clinical decisions, implementing the evidence-based approach in dental clinical practice is challenging. By establishing an overriding context of ethical practice parameters, the TCPS is designed to manage dilemmas of evidence and to facilitate the challenging task of translating best available scientific into appropriate clinical care. The framework of TCPS can help answer questions such as:

- Are diagnostic and treatment decisions guided mostly by limitations such as clinician experience, low-level evidence (e.g., expert opinion, case reports), and/or third-party benefit plans?

- Does the clinician have in place a higher level "operating system" which guides how he or she will advise and treat patients?

Utilizing ethical practice parameters is not a new way of framing decision-making. In medicine, it can be traced back to the phrase "First do no harm" originated by Hippocrates in his work, *"Of the Epidemics"* Book I, Section XI (400 BCE).⁶ From the authors' point of view, the two core ethical practice parameters that override all clinical care delivery are:

- **Maximize** safety, effectiveness and long-term value

- **Minimize** risks of harm

In dentistry, the TCPS has evolved from its predecessor, the Precautionary Context Clinical Practice Model.⁷ The essence of this framework is captured in commonsense aphorisms such as "Better safe than sorry," "An ounce of prevention is worth a pound of cure" and "Look before you leap." The TCPS shares its core philosophy of minimizing the risk of harm with a framework used by many governmental regulatory agencies, the Precautionary Principle (PP). However, as it is instituted on the government and large organization level, the PP does not readily appear to be applicable to dental clinical practice on the local level.

Emerging in European environmental policies in the late 1970s, the PP has been enshrined in numerous international treat-

ties and declarations. It is, by the Treaty on European Union in 1992, the basis for European environmental law and plays an increasing role in developing environmental health policies as well.⁸

The PP recognizes that the absence of full scientific certainty shall not be used as a reason for postponing decisions where there is a risk of serious or irreversible harm. Utilizing the PP, the government of Canada developed a framework which outlines the guiding principles for the application of precaution to science-based decision-making in areas of federal regulatory activity for the protection of health and safety and the environment and the conservation of natural resources.⁹

The TCPS, the PP and the Precautionary Context Clinical Practice Model are distinctive within science-based risk management.⁷ Making choices based on the least harmful alternatives challenges conventional risk management strategies. These are often guided by entirely different principles perhaps best reflected in the aphorism, "Nothing ventured, nothing gained."

How the TCPS Improves Clinical Decision-Making and Patient Care

Adopting the TCPS facilitates the opportunity to improve the way decisions are made in dental clinical practice. Instead of asking "How much risk will be allowed?" the TCPS asks a very different question: "How little harm is possible?"

Although dental care can never be completely risk-free, a risk that is unnecessary, and not freely chosen, is never acceptable. Adopting the TCPS facilitates integration and translation of the varied and potentially conflicting elements affecting the clinical decision-making process.

The TCPS provides a domain within which clinical decision-making is based on the best available scientific evidence – science that is explicit about what is known, what is not known, and what may never be known about potential hazards (**Diagrams A and B**).

The TCPS was designed to prevent harm, not to prevent progress. Applying

Table 1

Levels of Evidence*

Level Study Category: Therapy/Prevention, Etiology/Harm

- 1a. Systematic review of randomized controlled trials
- 1b. Individual randomized, controlled trial (with narrow-confidence intervals)
- 2a. Systematic review of cohort studies
- 2b. Individual cohort study (including low-quality randomized controlled trial; e.g., <80% follow-up)
- 2c. "Outcomes" research; ecologic studies
- 3a. Systematic review of case-control studies
- 3b. Individual case-control study
4. Case series (and poor quality cohort and case-control studies)
5. Expert opinion without explicit critical appraisal, or based on physiology, bench result research, or "proof of principle study"

* Ref. The *Journal of Evidence-Based Dental Practice*

the TCPS fosters innovation in producing better materials, safer products and alternative dental care delivery processes. The ultimate goal of the TCPS is to enhance the clinician's stewardship of patient care.

Unfortunately, the reality of today's regulatory system in the United States is that a lack of proof of harm is often misinterpreted as proof of safety. While this system has been successful in approving drugs that may help manage many problems, it has also been less effective in identifying long-term side effects, toxic properties and/or disease transmission risks for many therapeutic agents. Adopting the TCPS better enables the clinician to take action despite scientific uncertainty about the magnitude of risk of harm. This new framework removes excuses for inaction on the grounds of scientific uncertainty ("paralysis by analysis").

The Evolution of the TCPS in Clinical Practice

For many years, the patient care philosophy used by the authors was to "passionately provide excellence in therapy with exceptional patient service and care." Although satisfied that these objectives were being achieved, there was a desire to provide even better service by

refining the clinical practice model (what kinds of treatments were provided and the outcomes patients received). During the 1980s and 1990s, in each of our practices, we put in motion philosophies based on the guiding principles:

- Deliver treatment that provides the highest degree of safety, effectiveness, long-term value and patient comfort, and
- Ask always, "How little harm is possible?"

It was always considered an investment in both the patients' welfare and the dentists' practices to take the additional consultation time needed to review in-depth treatment alternatives and their risks/benefits as well as the patients' individual preferences and circumstances.

Putting our guiding principles into action on a daily basis in clinical practice was both exhilarating and demanding as it necessitated rethinking and revisiting some of the literature that guided decision-making. The TCPS evolved from these philosophies and has been serving our patients on a daily basis (**Diagram A**).

As we continue to do today, the revised questions we sought answers for always contained a component of

asking, "How little harm is possible and which treatments provide the highest degree of safety, effectiveness, and long-term value based on the quality of evidence available?"

At that time, and even today, it became evident that classic narrative literature reviews, specialty position papers and the publishing criteria of the vast majority of journals left much to be desired. Sifting through the volume of research publications and then translating it continues to be fairly difficult and time-consuming.

However, the situation markedly improved in dentistry toward the end of the last century with the recognition of the evidence-based approach. In 1998 and 2001, respectively, the *Journal of Evidence-Based Dentistry* and the *Journal of Evidence-Based Dental Practice* began publication. Since then, utilization of those publications as well as PubMed, Science Direct, Scopus and the Cochrane Collaboration Oral Health Group Reviews and Protocols have significantly contributed to the ability to have sound scientific footing for the TCPS (**Diagram A**) utilized in our private practices, research, and teaching. These resources enable an improved clinical decision-making process, as well as effectively increasing our ability to add, eliminate, or modify existing treatment protocols in order to meet the criteria set forth by the TCPS. Importantly, these resources are available at the point of care, in the office, where patients are treated.

The Absence of Evidence: How it Fosters Improved Clinical Care Changes

As a result of reviewing the scientific literature as well as product and procedure information, it became clear that the old admonition, "The absence of evidence is not evidence of absence" would become an important clinical decision-making tool. We found that there was a lack of reasonably strong scientific evidence to support the continuation of certain procedures and protocols that exposed our patients to unnecessary risks when assessed through the TCPS.

The following examples describe how the TCPS was used and how it can

be used to direct clinical decision-making, especially when high-quality scientific evidence is not available.

Using Sterile Water During Dental Surgery

It has been clearly demonstrated that the risk of disease transmission increases during surgical procedures with the use of nonsterile output irrigant/coolant.¹⁰⁻¹⁶ Also, due to the presence of a biofilm, the use of conventional dental unit waterlines (with or without filters) for surgical procedures increases the risk of disease transmission.^{11-13,15,16}

Although at the time there was an absence of evidence to establish a direct disease transmission cause-and-effect relationship, specifically in dental surgery, in 1993 the Centers for Disease Control and Prevention recommendations for dentistry advised that "sterile saline or sterile

water should be used as coolant/irrigant when surgical procedures involved the cutting of bone are performed."¹⁴

However, routine periodontal surgical practice continued to deliver potentially contaminated output irrigation water to the surgery site whether or not the source water was tap, bottled, or sterile – filtered or nonfiltered. This was because the irrigant was delivered by way of contaminated conventional dental unit waterlines. Even before 1993, the dental profession was aware of the risk problem, but no implementation guidance was provided at the organized dentistry level. By 1995, there still were no California or federal regulations enacted to enforce the 1993 CDC recommendation. The approach adopted was the more conventional risk-management strategy of waiting for disease transmission cases

to become a public health concern before enacting change.

When the clinician is faced with identified dental treatment risks, controversies, or issues not yet resolved at the larger agency level of government or organized dentistry, making clinical decisions by way of the TCPS enables taking action, despite scientific uncertainty about the magnitude of risk of harm. The overriding guiding principle of the TCPS states that the clinician delivers treatment that provides the highest degree of safety, effectiveness and long-term value while exposing the patient to the least risk of harm. This puts the patient's welfare at the foremost front of our clinical decision-making.

As an example of TCPS decision-making, in 1995, one of the authors, (Merijohn) eliminated all traditional dental unit waterlines from his practice

Table 2

Examples of Periodontal Surgical Clinical Care Changes Resulting From the *Absence* of Evidence

Procedure/protocol	Before evidence-based approach	After evidence-based approach
Output irrigation solution for periodontal surgical procedures (excluding endosseous implant placement surgery)	Contaminated irrigation solution: tap water, filtered tap water, filtered bottled water <i>Risk of harm: Disease transmission</i> ^{10-17,8-15}	USP sterile saline output irrigation
Dental unit waterlines (DUWLs)	<ul style="list-style-type: none"> ■ Use of nonsterilizable traditional DUWLs with in-dwelling filters ■ Use of air-water syringes attached to DUWLs <i>Risks of harm: Disease transmission</i> ^{11-13,9-11,15-17,13-15}	<ul style="list-style-type: none"> ■ Use of detachable irrigation tubing sterilized for each procedure ■ Use of sterile irrigation syringes
Rotary drill utilization for surgical bone recontouring and root surface modification	<ul style="list-style-type: none"> ■ Use of conventional high-speed, air-driven dental handpieces (sterilized) ■ Use of sterilized multiuse burs <i>Risks of harm: Introduction of air emboli into surgical spaces; heat trauma to, and excessive reduction of, bone and tooth structure</i> ^{18,19,16,17}	<ul style="list-style-type: none"> ■ Use of low-speed variable torque electric motor handpieces (sterilized) ■ Use of single-use sterile burs for bone recontouring
Grafting material	<ul style="list-style-type: none"> ■ Allogenic (human cadaver) ■ Xenogenic (animal source material) ■ Autogenous (patient tissue) <i>Risks of harm with allogenic and xenogenic tissues: Disease transmission</i> ^{20-24,18-22}	Autogenous tissues
Resorbable suture material	Xenogenic (gut) <i>Risks of harm: Disease transmission; autoimmune inflammatory reaction at surgical site</i>	Synthetic

and exclusively used USP sterile saline for output surgical irrigant/coolant. Sterile irrigant/coolant was, and continues to be, delivered via detachable irrigation tubing sterilized for each procedure or by sterile irrigation syringes (Table 2).⁷

In 2003, 10 years after its initial recommendation, CDC utilized an evidence-based approach to establish its updated Infection Control Guidelines. It recommended the following: “use sterile saline or sterile water as a coolant/irrigant when performing oral surgical procedures. Use devices specifically designed for delivering sterile irrigating fluids.” The level of evidence cited was Grade 1B: “strongly recommended for implementation and supported by experimental,

clinical, or epidemiologic studies and a strong theoretical rationale.”¹⁵

Finally, 12 years after the initial 1993 CDC recommendation and effective April 2005, the Dental Board of California updated the Infection Control Regulations of the Dental Practice Act (Section 1005, Section C 15: Irrigation) mandating that “sterile coolants/irrigants shall be used for surgical procedures involving soft tissue or bone. Sterile coolant/irrigants are deemed to be sterile when delivered using a device or process that has a Federal Drug Administration marketing clearance for delivery of sterile coolant/irrigants to the patient. Delivery of sterile coolant/irrigants shall be in accordance with the manufacturer’s directions.”¹⁶

As demonstrated in this example, utilizing the TCPS can enable practitioners to take action and decrease the potential risks of harm for patients well before mandated regulations go into effect.

Utilizing Human Cadaver and Animal Tissue Grafts in Dental Surgery

Are they safe and effective, providing patients with long-term value?

In this example of clinical care decision-making in the absence of evidence, the flexibility and adaptability of TCPS is illustrated. Raising and examining this question within the context of the TCPS allows for two different conclusions to be drawn.

Table 3**Key Dental Restorative and Caries Questions to Address Within the TCPS Context**

1. For a given clinical situation, are there greater tooth longevity risks associated with restorative intervention than with nonintervention?
2. What are the best methods for detecting early enamel caries and early dental caries?³⁵
3. What are the best indicators for an increased risk of dental caries?³²
4. What are the best methods available for the primary prevention of dental caries initiation throughout life?³⁶
5. What are the best treatments available for reversing or arresting the progression of early dental caries?³⁷
6. What are the most accurate methods available for distinguishing between the different stages of caries (e.g., cavitated/noncavitated; active/inactive; progressive/remineralizing; enamel only/dentin involvement)?

Table 4**Point of Care Clinical Questions to Answer Within the TCPS Context**

- Wait and watch, or treat?
- If treating, what is the best approach?
- Which approach decreases tooth loss risk and maximizes tooth longevity?

Common restorative clinical situations where there exists an absence of strong scientific evidence to guide clinical decision-making

1. Noncavitated pits and fissures
2. Enamel craze lines
3. “Leaky” restorations
4. Cracks in existing restorations
5. Tooth surface – restorative margin interface discrepancies (gaps, openings)
6. Abfraction sites

While strong scientific evidence has not demonstrated that cadaver and animal tissue graft materials are the safest, most effective and best long-term value approach in elective dental surgery, neither has it determined that there exists a proven cause-effect relationship routinely implicating these materials in disease transmission and patient morbidity.

However, although approved by the FDA, these grafting materials do carry warnings as they are not guaranteed risk-free from transmitting diseases to patients. Further, the best scientific evidence has

not definitively established that these materials provide significantly improved long-term, clinically relevant outcomes with respect to therapeutic effectiveness or improving tooth longevity, but high-quality evidence does exist that demonstrates allograft usefulness in clinical practice.

There are reported cases of disease transmission from the use of allograft materials in medical procedures. Although to date there are no published reports of definitive evidence of disease transmission cases resulting from their use in dental procedures, allograft tis-

sue recall alerts have been published because of recently discovered higher-than-normal disease transmission risks associated with some allograft tissue material used in dental surgery.²⁵

As is the case in the majority of treatment options in dentistry, relying strictly upon the currently available best scientific evidence and/or the absence of evidence can hamper clinical decision-making. In this example of whether or not to use cadaver and/or animal tissue grafts, both choices have reasonable scientific support but offer different risk exposures.

Using the TCPS enhances the clinicians’ decision-making ability. It provides an ethical parameters framework or “operating system” within which the clinician applies not only the best scientific evidence (**Diagram B**) and/or absence of evidence, but also factors in their clinical experience and judgment, as well as respects patient preferences/values in order to provide clinically relevant outcomes (**Diagram A**).

For example, utilizing the available evidence and assessing it using the TCPS, Merijohn in 1995 chose to eliminate the use of all human cadaver and animal tissue graft materials from treatment protocols (**Table 2**).⁷ Newman, utilizing the same available evidence, chose to continue to use autografts, allografts, xenografts and alloplastic materials in his treatment protocols. When they examined the scientific evidence within the context of the TCPS, the results provided these clinicians with an enhanced ability to make two different, yet appropriate clinical decisions.

Clinicians should always invest the time to educate patients of treatment alternative risks and benefits in order to foster a greater ability within each patient to make appropriate choices for themselves. Additionally, patient preferences and values should always be recognized and respected. It is the practice and recommendation of the authors that if the patient elects treatment procedures not provided by the clinician, that the patient be referred to others for further consultation and treatment.

Diagnosis and Management of Dental Caries and Common Restorative Clinical Issues in the Absence of Strong Evidence

In the evolution of caries treatment, dentistry has moved historically from extraction to decay removal and restoration (surgical intervention). Identification of early carious lesions and treatment with nonsurgical methods, including remineralization, represent the next era in dental care. In 1995, a supplement to the *Journal of the American Dental Association* first publicized this more conservative approach for worldwide dissemination.²⁶ However, the dental profession is only slowly progressing from “finding and filling” (surgical intervention) to “early detection and management.”²⁷

The stopping and reversing of caries is dependent on early and accurate diagnosis, which remains a developing field. If maximum benefits are to be obtained, improved diagnosis is essential.²⁸ Currently available evidence suggests that a large segment of the dental profession does not employ recommended conservative, noninvasive strategies to manage early occlusal lesions.²⁹⁻³¹

As dentistry moves toward early detection of lesions and a more preventive philosophy rather than a restorative orientation, improved dental caries risk assessment throughout life is needed.³²

How strong is the dental profession's evidence regarding the diagnosis and management of dental caries? As was concluded at the 2001 “National Institutes of Health Consensus Development Panel Conference on Diagnosis and Management of Dental Caries Throughout Life,” the diagnosis and management of dental caries is an evolving area in dentistry, many aspects of which are beleaguered by the absence of strong scientific evidence.

Visual and tactile diagnostic modalities appear to have satisfactory sensitivity and specificity in diagnosing substantial, cavitated, dental caries as does radiographic diagnosis of interproximal lesions. However, current diagnostic practices do not have sufficient sen-

sitivity or specificity to efficaciously diagnose noncavitated caries (early caries), root surface caries, or secondary caries. There is currently no diagnostic modality that can differentiate between microbiologically active caries and demineralized dentin without caries beneath a restoration.

The NIH panel was disappointed in the overall quality of the clinical data set that it reviewed. Far too many studies used weak research designs or were small or poorly described and, consequently, had questionable validity. Several systematic reviews of the literature presented at the CDC concluded that the majority of the studies were inadequate. At present, the dental profession is unable to accurately identify early lesions or lesions that are actively progressing.

These are major weaknesses in dentistry, especially in view of the significant percentage of restorations inserted to replace existing restorations.³² The absence of evidence to support routine, everyday restorative procedures is clearly a serious clinical problem.

The NIH panel concluded there was an absence of objective diagnostic methodology.³³ Although additional diagnostic devices have become commercially available since the 2001 NIH panel, as recently as 2005, it has been determined that identification methods for early occlusal caries are not yet accurate.²⁷

For example, the DIAGNOdent (KaVo America, Lake Zurich, IL) laser fluorescence device for detecting caries had just become commercially available at the time of the NIH conference. A recent systematic review of the performance of the DIAGNOdent in detecting caries found the device of limited value as a principal diagnostic tool because of its high false-positive diagnosis compared with those with visual methods. Further assessment of the DIAGNOdent in clinical and in vivo applications to detect caries activity or progression is needed if this tool is to be considered efficacious in the detection and hence treatment of caries.³⁴

As was illustrated in the previous

examples regarding surgical irrigation and bone grafting decision-making, utilizing the TCPS improves the ability to make appropriate restorative treatment decisions especially when strong scientific evidence is lacking. The TCPS provides the clinician with an overriding context within which to utilize the best available scientific evidence, clinician experience and judgment, and the preferences of the patient.

The TCPS is a very effective and practical method to examine the issues presented in **Tables 3 and 4**. A few examples of restorative and caries questions to answer within the context of the TCPS follow.

■ Which is the more appropriate recommendation: “Wait and watch” or treat?

■ If treating, what is the best approach?

■ Which approach decreases tooth loss risk and maximizes tooth longevity?

Clinicians investing the necessary time and resources for patient education will realize long-term gains both for their patients as well as their practices. The clinicians' goal is not only to recognize and respect patient preferences and values but to better enable the patients' decision-making process (**Diagram A**). In order for patients to make appropriate choices for themselves at the point of care, they need to be exposed to the best available evidence regarding therapeutic risks and benefits, long-term value, potential harm, safety, comfort, as well as esthetics. As dentistry progresses from “finding and filling” to early caries detection and management, the role of the dental professional as diagnostician, adviser, and consultant will become increasingly valued by both patient and dental care provider as well.

When the scientific evidence, or lack thereof, is assessed using the TCPS, the clinician can improve the way decisions are made (**Diagram B**). The strongest as well as the weakest evidence is critically assessed within a tangible framework. This helps simplify the decision-making process, enabling the clinician to choose the best available evidence based upon

which procedure(s) satisfy the two core ethical practice parameters of the TCPS that override all clinical care delivery:

- **Maximize** safety, effectiveness and long-term value
- **Minimize** risks of harm

Examples of Clinical Care Changes Resulting From the Presence of Evidence

The *Journal of Evidence-Based Dental Practice*, *Journal of Evidence-Based Dentistry*, PubMed, ScienceDirect, Scopus and the Cochrane Collaboration Oral Health Group Reviews and Protocols are examples of evidence-based resources which provide sound scientific footing for the TCPS way of thinking. The TCPS was designed for utilization in many settings, including private practice and teaching. **Table 5** outlines some of the positive changes adopted based on sound scientific evidence.

Practice Benefits Form Adopting the TCPS

The clinical care changes adopted in our practices by utilizing the TCPS have resulted in improved patient outcomes. From a practice management perspective, our practices benefit from incorporating the TCPS. Amongst other benefits, including providing a better level of care for our patients, it has facilitated the broadening of our scope of care. Educating our patients within the framework of the TCPS places demands upon our communication skills and time, but ultimately is very rewarding for both the patient and the practice.

For clinicians planning to incorporate the TCPS into their practices, it is important to note that all practice employees should participate in the process of adopting the TCPS. This creates a shared vision and an empow-

erment of the dental team through knowledge, thus enabling greater employee satisfaction.⁷

Conclusion

The TCPS provides an effective and systematic way to incorporate evidence-based decision-making at the point of care in clinical practice. Evidence-based decision-making in dental practice is rewarding and challenging. Although there will always be insufficiencies in the currently available best scientific evidence, this state continually improves over time.

For the private practice clinician, learning and sharing translational and evidence-based skills is a career-long enrichment process. As developments continue to evolve at the larger professional organization and agency level, transformational efforts

Table 5

Examples of Clinical Care Changes Resulting From the Presence of Evidence

Procedure / protocol	Before evidence-based approach	After evidence-based approach
In-office caries-prevention procedures immediately following all periodontal flap surgery suturing and at postop appointments	No treatment	Fluoride varnish application ^{38,27}
In-office caries-prevention procedures at dental hygiene maintenance appointments for higher-caries risk patients and root-sensitivity patients	Fluoride gel application	<ul style="list-style-type: none"> ■ Fluoride varnish application^{38,42} ■ Caries-risk assessment and prevention and dietary counseling³⁸
At-home caries-prevention recommendations	<ul style="list-style-type: none"> ■ Fluoride gel ■ Fluoride toothpaste (1,100 ppm) ■ Fluoride rinse ■ Occasional dietary counseling 	<ul style="list-style-type: none"> ■ Fluoride toothpaste (5,000 ppm)³⁸⁻⁴⁰ ■ Xylitol-based chewing gum and candy^{38,41} ■ Fluoride rinse³⁸ ■ Fluoride toothpaste (1,100 ppm)^{38,40}
Root-form endosseous implant (titanium screw) brands/manufacturers	Single	Multiple ^{43,44}
Toothbrush recommendations	Manual soft toothbrush	<ul style="list-style-type: none"> ■ Manual soft toothbrush ■ Powered toothbrush with rotation oscillation^{45,46}
Perio-systemic links	Cursory discussion with diabetic patients and people who smoke	<p>In-depth counseling, education, referral and/or treatment</p> <ul style="list-style-type: none"> ■ Diabetic patients⁴⁹ ■ People who smoke^{47,48,51} ■ Moderate- to higher-risk pregnancy and pre-pregnancy patients with moderate to advanced periodontitis⁵⁰ ■ Moderate- to higher-risk cardiac patients with moderate to advanced periodontitis⁵²⁻⁵⁴

made at the local level will more rapidly facilitate substantive health care gains for patients. The TCPS provides an effective means by which to achieve this goal. CDA

References / 1. Zerhouni E, The NIH Roadmap, *Science* 302:63-72, 2003.
 2. Zerhouni E, Translational and clinical science – time for a new vision. *N Engl J Med* 353(15):1621-3, October 2005.
 3. Sackett DA, Strauss SE, et al, Evidence-based medicine: How to practice and teach evidence-based medicine. Churchill-Livingstone, p1, 2000.
 4. Canadian task force on the periodic health examination: The periodic health examination. *Can Med Assoc J* 121:1193-254, 1979.
 5. Oxford-Centre for evidence-based medicine. Available at: http://www.cebm.net/levels_of_evidence.asp. Accessed May 7, 2006.

6. Hippocrates, of the epidemics, book 1, section XI (400 BCE). <http://www.geocities.com/everwild7/noharm.html>. Accessed May 7, 2006.
 7. Merijohn G, Advances in clinical practice and continuing education. The precautionary context clinical practice model: A means to implement the evidence-based approach. Interactive learning groups for evidence-based knowledge sharing. *J Evid Base Dent Pract* 5:115-24, 2005.
 8. Foster KR, Vecchia P, Repacholi MH, Science and the precautionary principle. *Science* 288(5468):979-81, May 12, 2000.
 9. A framework for the application of precaution in science-based decision making about risk. Government of Canada, National Library of Canada ISBN 0-662-67486-3; Cat. No. CP 22-70, 2003.
 10. Garner JS, CDC guideline for prevention of surgical wound infections, 1985. Supersedes guideline for prevention of surgical wound infections published in 1982. (Originally published in November 1985). Revised. *Infect Control* 7:193-200, 1986.
 11. ADA Council on Scientific Affairs, Dental

unit waterlines: Approaching the year 2000. *J Am Dent Assoc* 130:1653-64, 1999.
 12. Putins EE, DiGiovanni D, Bhullar AS, Dental unit waterline contamination and its possible implications during periodontal surgery. *J Periodontol* 72(3):393-400, 2001.
 13. Mills SE, The dental unit waterline controversy: Defusing the myths, defining the solutions. *J Am Dent Assoc* 131:1427-41, 2000.
 14. Centers for Disease Control and Prevention, Recommended infection-control practices for dentistry. *MMWR Morb Mortal Wkly Rep* 42(RR-8):7, 1993.
 15. Centers for Disease Control and Prevention, Guidelines for infection control in dental health care settings. *MMWR Morbid Mortal Wkly Rep* 52(RR-17):1-61, 2003.
 16. Dental Board of California, Infection control regulations, section 1005 minimum standards for infection control, section c 15: irrigation. 2005. Available at <http://www.dbc.ca.gov/chapter-1-regulation-article-1.htm>. (Accessed May 7, 2006.)

17. California Board of Dental Examiners. Infection control handbook, section 1005, paragraph 8: Minimum standards for care of dental equipment, 1994.
18. Branemark PI, Introduction to osseointegration. In: Branemark PI, Zarb GA, Albrektsson T, eds. Tissue-Integrated Prosthesis. Chicago: Quintessence 1985.
19. Eriksson AR, Albrektsson T, Temperature threshold levels for heat-induced bone tissue injury. *J Prosthetic Dent* 50:101-7, 1983.
20. Department of Health and Human Services, Food and Drug Administration, Human tissue intended for transplantation: Interim rule to require certain infectious disease testing, donor screening, and record-keeping to help prevent the transmission of AIDS and hepatitis through human tissue used in transplantation. *Federal Register* 58(238):65514-21, 1993.
21. The American Association of Tissue Banks, Recommendations for testing resulting from the workshop on current status of testing prospective tissue donors to prevent infectious disease transmission, June 5-6, Arlington, Va., 1994.
22. American Academy of Periodontology Committee on research, science, and therapy. Position paper: Tissue banking and periodontal bone allografts, April 1994.
23. Tissue banking of bone allografts used in periodontal regeneration *J Periodontol* 72:834-8, 2001.
24. American Academy of Periodontology, Keep track of bone allograft recipients, *AAP News* 30(11):5, 1995.
25. Member Alert: Allograft tissue recall, PERIO.ORG News Alert. American Academy of Periodontology, Nov. 4, 2005.
26. American Dental Association, Council on Access, Prevention, and Interprofessional Relations. Caries diagnosis and risk assessment: A review of preventive strategies and management. *J Am Dent Assoc* 126(Suppl):1S-24S, 1995.
27. Bader J, Shugars D, The evidence supporting alternative management strategies for early occlusal caries and suspected occlusal dental caries. *J Evid Base Dent Pract* 6:91-100, 2006
28. National Institutes of Health Consensus Development Panel. National Institutes of Health Consensus Development panel conference on diagnosis and management of dental caries throughout life. *J Am Dent Assoc* 132:1158, August 2001.
29. Fiset L, Grembowski D, Adoption of innovative caries-control services in dental practice: A survey of Washington state dentists. *J Am Dent Assoc* 128:337-45, 1997.
30. Eklund S, Pittman J, Heller K, Professionally applied topical fluoride and restorative care in insured children. *J Public Health Dent* 60:33-8, 2000.
31. Bader J, Shugars D, et al, Evaluation of audit-based performance measures for dental for dental care plans. *J Public Health Dent* 59:150-7, 1999.
32. National Institutes of Health Consensus Development Panel, National Institutes of Health Consensus Development panel conference on diagnosis and management of dental caries throughout life. *J Am Dent Assoc* 132:1155, August 2001.
33. National Institutes of Health Consensus Development Panel. National Institutes of Health Consensus Development panel conference on diagnosis and management of dental caries throughout life. *J Am Dent Assoc* 132:1160, August 2001.
34. Bader J, Shugars D, A Systematic review of the performance of a laser fluorescence device for detecting caries. *J Am Dent Assoc* 135:1413-26, October 2004.
35. National Institutes of Health Consensus Development Panel. National Institutes of Health Consensus Development panel conference on diagnosis and management of dental caries throughout life. *J Am Dent Assoc* 132:1154, August 2001.
36. National Institutes of Health Consensus Development Panel. National Institutes of Health Consensus Development panel conference on diagnosis and management of dental caries throughout life. *J Am Dent Assoc* 132:1156, August 2001.
37. National Institutes of Health Consensus Development Panel. National Institutes of Health Consensus Development panel conference on diagnosis and management of dental caries throughout life. *J Am Dent Assoc* 132:1157, August 2001.
38. Diagnosis and management of dental caries throughout life. NIH Consensus Statement 2001 18(1):1-24, March 26-28, 2001.
39. Den Besten P, Using toothpaste containing 5,000 ppm fluoride is more effective in rehardening root caries than using one with 1100 ppm fluoride. *J Evid Base Dent Pract* 1:97-8, 2001.
40. Alexander D, Increased levels of sodium fluoride in dentifrice provide greater anticaries effectiveness. *J Evid Base Dent Pract* 2:98-9, 2002.
41. Den Besten P, Xylitol gum chewing by mothers of infants may result in long-term lowering of mutans streptococci levels in their children. *J Evid Base Dent Pract* 1:99-100, 2001.
42. Cochrane systematic review. Fluoride varnishes for preventing dental caries in children and adolescents. The Cochrane Library 3:2002.
43. Cochrane systematic review. Interventions for replacing missing teeth: Different types of dental implants. The Cochrane Library 4: 2002.
44. Weyant R, Short-term clinical success of root-form titanium implant systems. *J Evid Base Dent Pract* 3:127-30, 2003.
45. Heanue M, Deacon SA, et al, Manual versus powered toothbrushing for oral health (Cochrane Review). The Cochrane Library, Issue I, Oxford, 2003.
46. Weyant R, Powered toothbrushes with a rotation oscillation action remove plaque and reduce gingivitis more effectively than manual toothbrushes. *J Evid Base Dent Pract* 3:72-6, 2003.
47. Bergström J, Tobacco smoking is strongly associated with periodontal disease. *J Evid Base Dent Pract* 3:92-3, 2003.
48. Bretz W, Smokers with adequate oral hygiene habits who visit the dentist at least twice a year have a greater prevalence and severity of periodontal disease at mandibular molar teeth than never-smokers with similar oral health practices. *J Evid Base Dent Pract* 3:98-9, 2003.
49. Ryan M, Poorly controlled diabetes is associated with a greater prevalence of severe periodontitis. *J Evid Base Dent Pract* 3:19-21, 2003.
50. Maternal periodontal infection may be associated with increased risk of preterm birth. *J Evid Base Dent Pract* 2(2):150-1, 2002.
51. Fiore MC, Bailey WC, et al, Treating tobacco use and dependence. Clinical practice guideline. Rockville, Md., U.S. Department of Health and Human Services, Public Health Service, 2000.
52. Gansky S, No difference in coronary heart disease rate between the NHANES I epidemiologic follow-up study respondents with baseline edentulism versus those with periodontitis. *J Evid Base Dent Pract* 2:110-1, 2002.
53. Novak J, Eliminating dental infections may not lower the risk of coronary heart disease. *J Evid Base Dent Pract* 2:112-4, 2002.
54. Merchant A, Results of study may not justify the association of periodontal disease with increased risk of cardiovascular disease. *J Evid Base Dent Pract* 2:147-9, 2002.

To request a printed copy of this article, please contact / George K Merijohn, DDS, 450 Sutter St., Room 2336, San Francisco, Calif., 94108-4202.