

## Evidence-based practice in dentistry

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*New Zealand Dental Journal 98: 32-35; 2002*

### SUMMARY

The importance of evidence in teaching and in support of clinical decisions is well established in health care, including dentistry. Defence of clinical decisions increasingly requires reliable data or evidence to support the stance taken. Assistance in finding the best evidence comes from a variety of sources, including computerised databases, journals, continuing education meetings, and study clubs. The randomised controlled trial heads the hierarchy of research designs on which evaluation of evidence is based; anecdotally based evidence and individual case studies are the least preferred study designs. Evaluation of a study requires a number of questions to be asked to determine how the study was performed, and whether it applies to a clinical situation. These questions relate to how the study was carried out, whether controls were used, were the results likely to be valid, and was statistical and clinical significance present. Quackery, pressure from consumers, and legal considerations have contributed to an increase in the importance of evidence-based practice.

The benefits, however, of evidence-based practice are that treatment decisions are easier to justify, especially when there is a complaint or a dento-legal issue, and the personal satisfaction that patients are being offered the best treatment.

In the last 50 years a plethora of new materials, drugs, interventions, and products have appeared. Accompanying this has been the development of many clinical techniques and methods of using the materials. How is the average practitioner expected to keep abreast of these developments? Do the materials and products work as claimed, and which claims will translate into improvements for both the patient and dentist? Unfortunately good clinical research is inherently slow to carry out, particularly the prospective randomised controlled trial, from which the best evidence is obtained<sup>1</sup>. Space in journals is limited, so publishing waiting times exist. In addition, products have frequently disappeared from the market by the time good trials are published. In an effort to overcome this, many companies publish pseudo-scientific papers in an attempt to provide some form of evidence to support their products. These range from clinical journals to advertising fliers, with much of the basis for these publications little more than anecdotal reports.

To run a full-time practice and also retain a commitment to reading up-to-date journals is difficult. Those who regularly read journals may find much of the information is obscure, or irrelevant, to everyday practice<sup>2</sup>. Additionally, patients are increasingly taking a role in their own treatment, and may no longer be simply content to take the first treatment offered<sup>3</sup>. Patients now have access to the same sources of information as the dentist, but without the critical skills to appraise the evidence<sup>4,5</sup>. Confounding this is the absence of quality control of the information available on the Internet<sup>6</sup>. As well, society has become more litigious, which demands that the current

standards of practice remain on a par with the best of clinical expertise. Despite this, it is almost impossible for even the most dedicated practitioner to keep abreast of the advances being made to the knowledge base of dentistry. Evidence-based dentistry provides a solution to this dilemma.

### EVIDENCE-BASED DENTISTRY

Evidence-based dentistry has been defined as "... the conscientious, expedient and judicious use of current best evidence in making decisions about the care of individual patients"<sup>7</sup>. An evidence-based approach has several advantages. One is that it will serve patients better because only tested procedures will be endorsed. A second is that it will increase the standing of the profession because it will ensure that proven treatments are offered<sup>8</sup>. The goal of evidence-based dentistry is high-quality, clinically orientated, and relevant research, which provides better information for the clinician and improved treatment for the patient. These methods, initially established at McMaster University in Ontario, Canada, have been developing in medicine for about 20 years. A number of journals have been introduced in the past 5 years that explicitly use evidence-based methods as the key element in the editorial criteria for publication. These journals include the *ACP Journal Club* and *Evidence-Based Medicine*. The concept of evidence-based dentistry has two central themes; best evidence-research, and the transfer of this to use in practice.

It involves four basic phases<sup>9</sup>:

1. Asking evidence-based questions (framing an answerable question from a clinical problem).
2. Searching for the best evidence.
3. Reviewing and critically appraising the evidence.
4. Applying this information in a way to best help clinical practice.

Carr and McGivney<sup>10</sup> have suggested a fifth phase:

5. Evaluation of performance of the technique, procedure, or material.

Use of this approach when evaluating clinical decisions has the advantage that it structures the way clinical problems are considered.

### SEARCHING FOR THE BEST EVIDENCE

More than 600,000 articles are published each year in biomedical journals<sup>11</sup>. Clinicians who want to stay abreast of significant changes in their areas of health care need help in dealing with this volume of literature. Using an evidence-based approach aids clinicians in selecting the relevant articles, and assists them to efficiently extract and apply the information<sup>11</sup>.

Computerised medical databases, such as Medline, have made it easier to distribute and access information<sup>12</sup>. Literature searches as little as 15 years ago required going to the library, finding a copy of *Index Medicus*, searching topics 1 year at a time, hand-copying the appropriate references, and then going to the stack of bound journals to find the article. Now, from the home or office, a medical

database can be accessed online, the literature searched, and the relevant abstracts and articles printed to be reviewed.

### Where is the evidence found?

*Medline:* Medline is the standard English-language database for biomedical information. Similar databases are available in several other languages. Medline can be accessed through several gateways:

- Embase ([www.embase.com](http://www.embase.com)), which is a subscription-only database.
- PubMed ([www.ncbi.nlm.nih.gov/PubMed/](http://www.ncbi.nlm.nih.gov/PubMed/)). This is the National Library of Medicine's free access server, providing access to over 11 million Medline citations back to the mid-1960s, and additional life-science journals. PubMed includes links to many sites that provide full-text articles and other related resources.
- Medscape ([www.med-cape.com](http://www.med-cape.com)). This site can be used to search Medscape professional, or Medscape Health, which is more for the general public.
- HealthGate ([www.healthgate.com](http://www.healthgate.com)). This site is a business venture that is listed on the NASDAQ. It provides health-care information to health-related organisations, and was established in response to the events of 11 September 2001. HealthGate has created the Trauma Centre, which comprises a series of articles, fact sheets, and resources to help people understand and manage the physical and psychological effects of those tragic events.
- IntelliHealth ([www.intellihealth.com](http://www.intellihealth.com)), which incorporates the Harvard Medical School's Health Information Pages. This site provides health-related information at a lay-person level.
- MedPortal ([www.medportal.com/medlinks.html](http://www.medportal.com/medlinks.html)), another access line to PubMed.

*The Cochrane Collaboration:* ([www.cochrane.org](http://www.cochrane.org)) and ([www.update-software.com/cochrane/](http://www.update-software.com/cochrane/)). This site is named after Archie Cochrane, a pioneer in the field of evaluation of medical interventions. It aims to prepare, maintain, and disseminate comprehensive and systematic reviews of the effects of health care. The Cochrane Centre was founded in Oxford in October 1992, and has grown to include collaborating groups from all over the world. The Centre provides a library of randomised controlled trials currently being performed, and this includes the Cochrane Oral Health Group ([www.cochrane-oral.man.ac.uk/default.htm](http://www.cochrane-oral.man.ac.uk/default.htm)).

*Other sources:* The following are Internet data sites that are based on evidence-based practice or principles.

- The Centre for Evidence-Based Dentistry ([www.ihs.ox.ac.uk/cebd/](http://www.ihs.ox.ac.uk/cebd/)), an Oxford-based reference source for training in evidence-based techniques; it includes the Centre for Evidence-Based Medicine (<http://cebm.jr2.ox.ac.uk/>).
- Bandolier ([www.jr2.ox.ac.uk/bandolier](http://www.jr2.ox.ac.uk/bandolier)), a synthesis of bullet-point headings from primary health journals using evidence-based methods.
- ScHaRR ([www.shef.ac.uk/~scharr/ir/netting/](http://www.shef.ac.uk/~scharr/ir/netting/)). The University of Sheffield School of Health and Related Research provides this Internet resource for finding evidence.
- DARE ([www.agatha.york.ac.uk/welcome.htm](http://www.agatha.york.ac.uk/welcome.htm)). The University of York provides this database which consists of Abstracts of Reviews and Effectiveness.
- *New Zealand Evidence-Based Healthcare Bulletin* ([www.nzgg.org.nz/bulletin.cfm](http://www.nzgg.org.nz/bulletin.cfm)). This site is a joint initiative of the New Zealand Guidelines Group (NZGG), the New Zealand Centre for Evidence-Based Nursing (NZCEBN), the New Zealand Health Technology Assessment (NZHTA), and

the New Zealand Cochrane Fellow. The purpose of the *Bulletin* is to summarise news and information about evidence-based health-care activities in New Zealand.

*Other strategies:* Other strategies available to aid the dentist in keeping abreast with the current literature are<sup>11</sup>:

- Professional journals, many of which are now available on-line.
- Books, audio and video tapes, and CDs. Because of production time, these are not likely to have the most current information, and may suffer from the personal bias of the authors.
- Professional and university continuing education meetings. Participants at such meetings can interact with the author of the new evidence. Unfortunately, the evidence in support of effective transfer of continuing education content to clinical practice is mixed<sup>11</sup>.
- Study clubs. Formed with colleagues of like mind, study clubs provide members with a commitment and an economy of effort in attempting to read the literature and in making evidence-based decisions.

## REVIEWING AND CRITICALLY APPRAISING THE EVIDENCE

### The hierarchy

Understanding “strength of evidence” and the idea of a “research design hierarchy” is at the heart of evidence-based dentistry. The “gold standard” has changed from the randomised controlled trial (RCT), to the systematic review of RCTs, as more of these studies are published<sup>7</sup>. Traditional literature reviews are conducted, using expert opinion to define the questions and to select and summarise the evidence; systematic reviews are conducted by collaborative teams of experts and methodologists, trained in searching, appraising, and summarising the evidence. Clearly defined study inclusion and exclusion criteria have been adopted<sup>13</sup>. The study-type ranking, from best, is as follows:

1. Systematic review of multiple, multi-centre, prospective, randomised controlled trials.
2. Well-conducted, double-blind, prospective, randomised controlled trials.
3. Well-designed clinical trials, possibly longitudinal, but without randomisation.
4. Well-designed clinical trials that are cross-sectional.
5. Matched case-controlled studies.
6. Well-designed experimental studies that do not have controls.
7. Anecdotally-based evidence, which includes descriptive studies and opinion from respected authorities in the field.
8. Individual case studies.

A more detailed review of study strength can be found in Jacob and Carr<sup>14</sup>. The majority of today's clinical practice is based on the last two types of study.

### Evaluating the studies

When evaluating a study, or the evidence, a number of questions need to be asked about how the study was performed and its applicability to the clinical situation. These questions include<sup>7,15</sup>:

- How was the study carried out?
- Was there an independent, blind comparison with a control?
- How do the aims and study design contribute to the understanding of a clinical condition or decision?
- Were the methods for performing the test described in sufficient detail to permit replication?
- Are the results likely to be valid?

- What are the results of the study, and will they help provide better treatment of patients?
- Were both statistical and clinical significance considered?
- How does the subject population of the study compare with the patients that make up clinical practice?
- Are the findings applicable, relevant, and feasible in clinical practice?
- What are the risks and will the patients be better off?

Finally to be considered is whether the treatment or outcome has some relevance to a primary patient concern. It is possible that a publication on a particular procedure may have no relevance to an actual clinical concern, and is therefore not beneficial for answering clinical questions.

It should not be forgotten that many new treatment options have been introduced without randomised controlled trials. Dental implants are a good example. The introduction of osseointegration was based on a large case study, which was well followed-up, but nonetheless uncontrolled<sup>16</sup>. The reason for this is that there are relatively few of the "gold standard" studies, the randomised controlled trials, in dentistry. Randomised control trials are expensive to conduct, difficult to blind, and often require limited inclusion criteria, or are ethically impossible to undertake<sup>17</sup>. In the absence of randomised controlled trials, one is left to seek the next best evidence, and to rely on it as much as possible given the weaknesses. This is best done by vigorous examination of the methodology and results. By using a hierarchical analysis of the literature, clinicians can determine a treatment plan based on the best available evidence.

### PROBLEMS WITH EVIDENCE-BASED DENTISTRY

We are all familiar with the comment "well, it works in my hands". As a generalisation, if dentists have been taught a particular procedure or technique, and it apparently gets a satisfactory result, they will tend to continue to use it. In terms of a scientific approach though, that is not acceptable because it is anecdotal-based evidence<sup>18,19</sup>. The ideal study is the randomised-controlled trial that controls for all possible variables that might alter or affect a given result<sup>7</sup>. Consequently, the researchers sometimes have to filter out the various influences that could upset their observations – influences such as patients arriving late, not brushing their teeth regularly, eating the wrong things, falsely reporting they use fluoride toothpaste twice a day, smoking, and a myriad of other things that make them human. It might be randomised, and it might be controlled, but is it real<sup>18</sup>? In addition, randomised clinical trials are not foolproof. The size of the experimental and control groups must be sufficiently large for the conclusions to be reliable. Studies where the sample size is too small risk an erroneous conclusion.

Other problems exist with finding the most recent evidence: randomised clinical trials are expensive and difficult to run, and publication waiting times are compounded by Medline being 6-8 months behind many journal publication dates<sup>16</sup>. In addition, few clinical situations in dentistry are life-threatening, so the impetus to perform rigorous clinical research to compare efficacy of dental therapies may not seem as important as in medical therapies<sup>14</sup>.

### CONSUMER PRESSURE

Contemporary patients appear to be better educated, and more assertive and sceptical of health care providers<sup>3</sup>. Access to the Internet medical databases such as Medline is now also commonplace in many households. This allows patients to use the same information sources as clinicians. As a result,

some patients may not trust their dentist's knowledge or judgment<sup>3</sup>. Consequently, simply reading journals and attending continuing education courses, with knowledge supplemented by consulting colleagues, may not be enough to satisfy some patients' demands for assurance of treatment effectiveness. Treatments that are offered are often those that can best be described as the practitioner's routine, or that which the practitioner has determined is the therapy the patient would most likely choose<sup>20</sup>. Patients, however, frequently assume that the dentist is offering only the best or the only treatment available for their condition. Patients therefore expect that the recommended treatment is based, at least in part, on the best possible therapy, hence the need for evidence-based practice. This does not suggest, however, that treatment should be driven by the literature alone, without clinical judgment, any more than one could suggest that clinical judgment should ignore the evidence. Evidence-based practice is unlikely to reveal one best way of doing things. This is where clinical judgment is indispensable.

### LEGAL CONSIDERATIONS

Society is becoming more litigious<sup>21</sup>. If a dentist is sued, what information is required to provide an adequate defence? Is there proper documentation of the examination, diagnosis, and any tests? Does the treatment measure up to the current standards of practice, and is there documentation that those standards have some validity? There are two types of treatment, therapeutic and non-therapeutic<sup>3</sup>. Therapeutic treatment is defined as treatment that has an established beneficial outcome, whereas non-therapeutic treatment is defined as the use of procedures that have no established beneficial outcome<sup>3</sup>. For non-therapeutic treatment in particular, informed patient consent must be obtained. Informed consent should include details of the treatment and outcomes, all of the risks and benefits, as well as any notes on communications and comments. However, obtaining valid consent means that the dentist must be able to explain the recommended treatment. Some of the other problems with obtaining consent are<sup>21</sup>:

- Lack of relevant knowledge by the health professional.
- How much information to give the patient in a specific situation.
- Ability of the patient to comprehend the information given.

The use of therapeutic procedures, identified by evidence-based treatment principles, based on informed consent, carried out by skilled and competent professionals, offers a way to minimise claims of medical negligence.

### QUACKERY

A quack has been defined as anyone who promotes medical schemes or remedies that are unproven, known to be false, or for a profit. Although some accepted forms of medical or dental treatment may not satisfy the evidence-based treatment model, they can be distinguished from quackery or alternative medicine. Alternative medicine does not derive from any coherent or established body of evidence, and is not subjected to rigorous assessment to establish its value<sup>3</sup>. Characteristically, quackery relies on personal testimony and anecdotal evidence in place of scientific assessment. Personal testimonies are not used in scientific dentistry to prove the effectiveness of treatments, because the observations are not made objectively under controlled conditions, making assessment of the treatment difficult<sup>3</sup>. Yet personal testimonies on being cured are a powerful means of influencing opinion because of the belief that personal experience is the best way of telling whether something works.

Personal experience is reliable when the treatment under consideration has a large effect, occurs quickly, and has a clear outcome – such as hitting one's thumb with a hammer. The reliability of personal experience declines markedly in instances where the symptoms are variable, the time course is long, the effects of treatment complex, and the outcome measures ill defined. Quacks thrive on treating conditions with variable and ill-defined symptoms. There are several reasons why their treatments may appear successful<sup>22</sup>:

- The placebo effect.
- Variability in the progression of the disease.
- Natural regression of a disease.
- Reporting bias favours apparent positive treatment outcomes.
- Some patients receive multiple forms of treatment.

Health practitioners are currently exposed to media reports with claims of cures for cancer, books debunking conventional medicine, and gurus urging a return to folk remedies, special diets, avoidance of proven therapies, and outright hawking of unproven methods known only to the “healer”<sup>3</sup>. How are these claims answered, and how are requests for such therapies from patients who are vulnerable to trying anything when conventional therapies do not seem to be helping them best handled? What separates the professional from the alternative practitioner is an adherence to scientific protocol, as well as tests and treatment based on proven techniques and documented evidence-based studies<sup>3</sup>. If dentistry, as a profession, provides treatments and tests based solely on personal empirical observations – “it works in my hands” – dentists would be no more credible than those dismissed as alternative practitioners<sup>3</sup>. Evidence-based dentistry is the only effective defence available to anyone accused of quackery.

Quackwatch (<http://www.quackwatch.com>) is a website dedicated to this subject. It is operated by Stephen Barrett, a retired psychiatrist.

## CONCLUSIONS

Dentists are expected by patients, colleagues, and Government to keep abreast of new techniques and developments. But continuing professional development is just a part of practising evidence-based dentistry. Evidence-based dentistry is the use of current best evidence in making decisions about the care of individual patients. Providing evidence-based dentistry makes practitioners question and think about what they are doing. Information needs to be assessed, and its validity determined. Practising evidence-based dentistry does require that time is spent searching and assessing the literature, and questioning what is read and told. The benefits of evidence-based practice are that treatment decisions are easier to justify, especially when there is a complaint or a dento-legal issue, and the personal satisfaction that patients are being offered the best treatment.

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