

Evidence-based principles in Orthodontics: What Does it Really Mean?

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INTRODUCTION

The words "evidence-based" have become great buzzwords of late in the orthodontic literature, with a plethora of editorials and articles dedicated to this topic¹⁻¹¹. The 2007 European Orthodontic Society congress is testament to the popularity of this concept, with no fewer than three oral presentations dedicated to this topic. The words "evidence-based" when appearing in orthodontic journals, have become somewhat synonymous with good science. But, what does evidence-based really mean?

Evidence-based medicine (EBM) has been defined as the process of 'systematically finding, appraising and using contemporary research as the basis for clinical practice'¹². Applying EBM principles to dentistry, the American Dental Association developed the following definition for the term "evidence-based dentistry," or EBD: "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"⁴. This definition clearly identifies three domains which are incorporated for the provision of evidence-based dental care; namely, best scientific evidence, dentists' clinical expertise and patients' preferences.

The concept of evidence-based practice has been around for at least 15 years¹³. It seems, however, that dentistry and orthodontics have lagged behind medicine in the quest to incorporate science into clinical practice. Perhaps the art in the practice of dentistry has overshadowed the need for science. In the present age of evidence-based orthodontics (EBO), orthodontists need to understand the basic tenets of science and research⁸.

HISTORICAL PERSPECTIVES

For many years, before the scientific era, observation was a major source of progress in therapeutics. Without observation, penicillin and the smallpox vaccine may not have been discovered. Edward Angle's contributions to modern orthodontics were based largely on keen observation and clever mechanics¹⁰. Whilst observational research has been fairly successful in the advancement of orthodontics, this type of research could be devalued by being labeled as "anecdotal". Hence the long-standing call for orthodontists to have a deeper understanding of science and research⁸.

Proffit in 1985¹⁴ wrote: "The orthodontic practitioner is akin to the scientist who must continually evaluate new research findings." Furthermore, Vig in 1986¹⁵ stated: "Orthodontists have laid greater emphasis on mastering their art than mastering their science. . . . There are many orthodontic controversies, past and present, that center on whose art is superior." Johnston in 1990¹⁶ claimed: "Those who advocate new therapies seem disinclined to provide evidence of efficacy (it may be bad for business); the profession as a whole, perhaps being convinced in dental school of the irrelevance of 'science,' seems equally disinclined to demand it." And it is conceivable that the apparent disregard for the principles of scientific inquiry prompted Moore in 1985¹⁷ to write: "Clearly, the promulgation of simple rules and pat formulas and the immediate and uncritical adoption of them prior to testing... have inhibited true progress."

MODELS OF EBD/EBO FOR CLINICAL DECISION-MAKING

The evidence-based paradigm has three hierarchical model levels^{4,6}. These models aid in guiding the clinician to become more objective about a specific topic. Their principles apply equally to dentistry and to orthodontics.

Model 1 - or the experiential model¹⁸ is dynamic and provides direct feedback (for example, the restoration resolved the patient's pain and, therefore, was the appropriate treatment). On the other hand, this model's major drawbacks include an inadequate scrutiny of the biases of the master clinician or educator, and the absence of formal and independent mechanisms for considering clinical observations that do not agree with the master educator's opinions⁴.

Model 2 - A second approach to clinical learning and decision making builds on Model 1 by adding an important element. In addition to relying on experiences and expert opinions, dentists adhering to Model 2 search for the best scientific studies that might provide information that can assist in resolving a clinical problem. Orthodontists who take this approach are expected to critically appraise the information provided in scientific studies and judge the validity of every conclusion⁴.

Model 2 may result in better decisions regarding clinical care and, most importantly, provide clinicians with opportunities for lifelong learning. However, a major drawback of this model is that it requires nearly constant searching for evi-

dence, an unrealistic expectation for most clinicians⁴, who in any event may be unable to identify all the relevant studies.

Searching for all available evidence is time-consuming and requires expertise in searching databases of published studies¹⁹. The task has become much easier since the availability of abstracts on *Pubmed* and systematic reviews published by the Cochrane collaboration⁷. Nevertheless, Model 2 may still result in biased conclusions, because a clinician may find only some of the evidence or may select only particular evidence that confirms his or her point of view, dismissing other studies that offer contrary viewpoints.

Model 3 - To resolve these problems, the EBD/EBO process offers a third model. In this approach, the clinician locates and uses systematic reviews of all the evidence that addresses a specific clinical question. Systematic reviews bring together large amounts of information from as many published and unpublished clinical trials as possible and analyse the data in a process called meta-analysis²⁰. This is a method of combining the results from several different studies in order to obtain an overall estimate of the effectiveness of a particular intervention which can then be used by clinicians, researchers, policy makers and patients to make decisions about health care. This relatively new scientific activity has evolved to produce systematic reviews which separate the insignificant, unsound or redundant deadwood in the literature from the salient and critical studies which are worthy of further consideration²¹. Systematic reviews are now seen as the foundation stone of our pyramidal hierarchy of evidence²³.

Randomized controlled trials (RCT's), which confirm the same hypothesis, have, for many years, been recognized as providing the strongest level of evidence of the treatment effect of therapeutic interventions^{3,11,22}. Johnston²⁴ acknowledged the importance of RCT's in an evidence-based research environment. However he also pointed out that it is incorrect to think that only RCT's can produce trustworthy results and he mentions that RCT's cannot always be used in the study of orthodontic patients.

Accordingly, practitioners who follow Model 3 rely on systematic reviews conducted by teams of clinicians and methodologists. The disadvantage of Model 3 is that the systematic reviews require expertise and time, and are currently limited in the scope of clinical questions they address⁴.

Ismail and Bader⁴ do not advocate the use of only one model with regard to clinical decision making or lifelong learning. However, Model 1 by itself is insufficient to ensure that orthodontists consistently provide the best care to the public. An evidence-based practitioner should follow Model 2 if there is enough good-quality clinical evidence or, ideally, Model 3 if a systematic review of the evidence is available.

IMPLICATIONS OF EBO

Scientific evidence, when collected and analyzed systematically, can provide useful and current information to dental practitioners. However, scientific evidence by itself is insufficient for orthodontists to provide appropriate orthodontic

care. By necessity, when recommending treatments, orthodontists should also consider the circumstances of the patients and their preferences regarding outcomes. Expanding the scientific basis for clinical care will also increase the information available to patients, and could significantly affect the choices they make regarding their oral health care. In an evidence-based model of clinical practice, a patient's consent for treatment requires full disclosure of scientifically validated information. In instances in which the evidence is lacking or weak, patients should be so informed²⁵. While EBO may seem to intrude on orthodontists' autonomy, the benefit of this practice model is that it protects clinicians from legal liability by fully disclosing all information that has been critically reviewed by orthodontists and methodologists⁴.

In the current information era, knowledge is both a tool and a commodity that can be used to improve the decisions made by dentists every day⁴. EBD/EBO helps clinicians by providing simple and validated scientific summaries. Personal experience, because of its potential for bias, should no longer be the sole source of lifelong learning in dentistry. Furthermore, the lack of consistency in treatment decisions among dental and medical practices is problematic. Shifting from a reliance on the experiential model of decision making to an evidence-based model would benefit all health care professions, as well as their patients^{4,7}.

On the other end of the spectrum, there are orthodontists who are opposed to implementing an evidence-based approach to orthodontic practice. The most commonly cited reasons have been firstly, the difficulty in accessing information and secondly, that EBO lessens the importance of clinical judgement⁷. In addition to these there has also been concern that EBO will allow legislators to impose rigid regulations on the profession, and that this approach will not work as treatment is on individuals and not averages²⁶. Although these considerations seem valid, it should be noted that EBO is not a cook-book approach to orthodontics. On the contrary, it still relies heavily on intelligent, thoughtful, and open-minded orthodontists to use the best evidence available as they develop treatment plans for their patients⁷. Regarding the accessibility of information, this concern does not hold true today as the use of the internet has made the required scientific material readily accessible.

A primary advantage of the evidence-based practice model is that it provides the least-biased, best-validated information on which to base decisions. However, scientific evidence for many aspects of clinical dentistry is either weak or non-existent. This presents the dental profession with a major hurdle in implementing an evidence-based model of clinical practice⁴.

CONCLUSIONS

In the evidence-based approach to clinical decision making, orthodontists incorporate the best scientific evidence, evidence that is critically appraised in systematic reviews together with clinical experience and their patients' preferences for treatment outcomes. Although we live in an information-rich age, the general dental and orthodontic literature seems to be lagging behind when it comes to evidence-based research. Orthodontic literature still relies a lot on the classical observa-

tional studies and most new material being published in the recognized journals still fail to use the evidence-based ideals.

The recent appearance of two journals, *Evidence-Based Dentistry* and *The Journal of Evidence-Based Dental Practice*, is a major step forward. Both of these journals are devoted to critically appraising clinical studies and presenting information in a format that clinicians can readily use. These journals together with the contributions of *Pubmed* and the Cochrane collaboration make accessing the appropriate information easier today than ever before.

The trend towards evidence-based treatment seems set to continue, but the difficulty in applying it in orthodontics should not be minimized. Some of the factors that contribute to the difficulty include¹⁰:

1. Treatment occurs over an extended period of time;
2. The amount of growth and its direction vary considerably among patients;
3. Patient cooperation has a significant effect on outcome;
4. Response to the same orthodontic forces varies among patients;
5. Skeletal morphology can complicate treatment;
6. Parafunctional muscular habits can influence tooth movement;
7. Mode of respiration may influence eruption and growth;
8. Other factors can affect treatment.

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From my own experiences as a registrar, it is conceivable to think that if a patient seeks orthodontic opinions from five orthodontists, he or she may receive five different treatment plans. It also is conceivable that all five treatment plans could achieve satisfactory results, with most clinicians citing the reasons for their choices as being: *"this is what works in my hands"*. However, when viewed in light of the principles of effectiveness and efficiency, there might be only one or two treatment alternatives that best satisfy the patient's aesthetic, functional and psychosocial needs.

As more studies are conducted using the principles of evidence-based orthodontics, the discipline may have to re-analyze what is being taught at postgraduate programmes and what is being practiced in the private sector. This challenge to integrate the accrued scientific evidence into clinical orthodontic practice is the next major hurdle facing orthodontics. Until this challenge is met, orthodontists will not be able to confidently present a forthright and accurate cost/benefit analysis to the patient and, therefore, will not secure truly informed consent⁵.

To conclude, Proffit²⁷ wrote: *"Orthodontics has no choice but to become a data-based specialty"* and that we should *"do it sooner rather than later, willingly rather than unwillingly, taking the lead rather than being dragged along"*. If this occurs, in a few short years we will all be using EBO.

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Additional references (12-27) are available on www.sada.co.za