

I am willing to help the Academy in their efforts to promote and encourage an increased interest in periodontal therapy throughout the profession. I see the problem; however, the global need for periodontal therapy is out of my realm of primary concern as a practicing prosthodontist, researcher and educator.

Dr. Krebs may be interested to know that I have had numerous positive letters, e-mails and calls about the editorial he criticized. Apparently, many dentists are in favor of minimally invasive dentistry, with its varied interpretations.

**Gordon J. Christensen,  
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1. Christensen GJ. I have had enough! Dent Town Magazine 2003;4(9):10, 12, 74-5.
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### CONCLUSIONS QUESTIONED

I know that Dr. Christensen has done a lot for the profession and has great influence on the practice of dentistry in the United States. His September JADA column, "Bonding to Dentin and Enamel: Where Does It Stand In 2005?" (JADA 2005;136:1299-1302), probably will change the way some dentists practice.

I find, however, that a number of his conclusions cannot be supported by the literature and, therefore, find fault with JADA for publishing them. Dr. Christensen should continue to offer his opinion in the CRA Newsletter. Each reader can then give his opinion pieces the confidence they find that they earn.

Following are specific quotations from Dr. Christensen's column with which I take issue:

Page 1300: "In vivo longevity studies on the retention of dentinal bonds are sorely needed."

I found 50 clinical studies of dentinal bonds in a short search on PubMed. The success rates have ranged from excellent to terrible. The no-wash systems, which Dr. Christensen advocates so strongly, have consistently been the systems with the higher failure rates, when compared with the total-etch systems. Most new bonding systems are tested clinically using noncarious cervical lesions as the model. These are a true test of dentin adhesion in a clinical setting. To say that there are no in vivo longevity studies is absolutely incorrect.

We have data sets from exfoliated primary teeth that indeed indicated that bond strength to dentin decreased over time.

After the stresses and strains of polymerization shrinkage have been overcome, it may be that the 17 or 20 megapascals, number suggested as necessary for resin-based composite success is not required for good performance. Dental amalgam, which shrinks 50 to 100 times less than hybrid resin-based composites, has bench top bond strengths that are in the range of 4 to 6 MPa when bonded to dentin with partially filled resins.

Summitt and colleagues<sup>1</sup> followed large amalgam restorations bonded with Amalgam-bond Plus (Parkell, Farmingdale, N.Y.) with HPA for six years. There were 11 clinical failures due to loss of vitality, caries or adjacent cusp fracture. During those six years, none of the adhesively retained amalgams separated from the tooth.

Page 1301: "Total-etching

dentinal bonds accomplished meticulously can be excellent,<sup>2</sup> but many of them require several steps that can be confusing in a busy practice."

Good dentistry is full of the need for meticulous attention to detail. In my roles as a clinician, mentor and teacher, I am very willing to accept a simpler technique at any time when the results are as good as, or better than, the more complicated system.

Tay,<sup>3</sup> Perdigao and colleagues,<sup>4</sup> and De Munck and colleagues<sup>5</sup> have done extensive research on resin bonding. Based on their research and the research of others the etch-wash-primer-adhesive systems still are superior in reliability to the no-wash systems. The fact that no-wash is easier, but may be inferior, is missing from page 1301.

Page 1301: "Again, clinical in vivo research is needed to substantiate or refute the longevity of dentinal bonding to teeth in the mouth."

Long-term clinical trials are very expensive. Some research data will lose value should the formula for the tested bonding system be altered before the long-term clinical trial is completed. We do have clinical data on fourth-generation systems that show very good results. The amount of clinical research on no-wash systems is smaller, of shorter duration and demonstrates that the early performance of the no-wash systems was not as successful as the systems with separate etch, wash, prime and adhesive steps. Selected no-wash systems have approached the clinical success rate of the fourth-generation systems.<sup>1,6-13</sup>

Page 1301: "There appear to

be well-founded reasons for clinicians' obvious lack of confidence in some well-controlled, peer-reviewed, in vitro studies of dental bonding...".

It is incorrect to intimate that laboratory research is never related to clinical performance of bonding systems. The first-generation dentin bonding systems and early no-wash systems had very low laboratory bond strengths and then equally unsatisfactory clinical performance. In the evaluation of two newer self-etch systems, Domnez and colleagues<sup>14</sup> placed the bonding agents on 24 teeth. Eight of the teeth were extracted the next day, and 16 of the teeth were extracted at one

year. The bonding protocol was repeated in vitro on those extracted teeth. The study concluded that "there is no difference between the mechanism of degradation of self-etch adhesives in vivo or in vitro."

Clinical trials are the gold standard of medicine. However, there is certainly a great deal that can be learned from laboratory trials, prior to subjecting humans to new techniques or materials. If it performs poorly in the laboratory, the technique or material should never be used in humans.

In the rush to discover the "quick and easy," some dentin bonding systems have made it to the commercial market ignor-

ing the inconsistent or poor performance in the laboratory.<sup>6</sup> That was a disservice to the public and to dentistry. Dr. Christensen's suggestion to discount all laboratory data also would be a disservice.

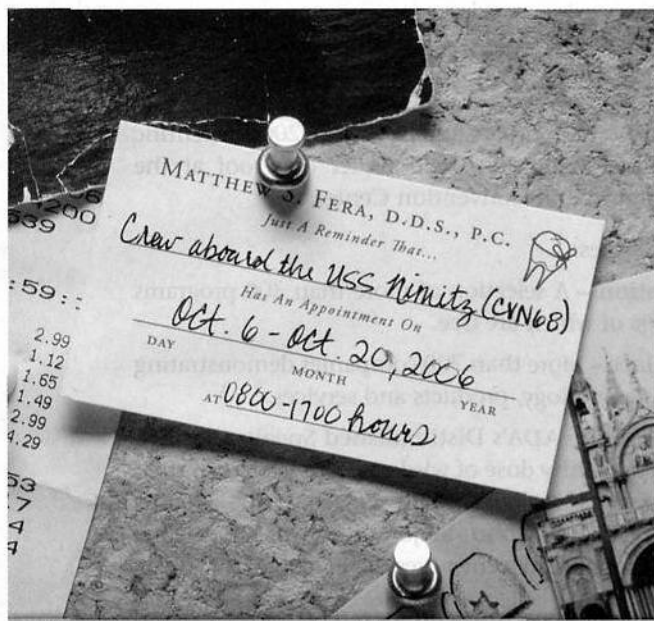
Page 1301: "When only a small amount of enamel is present on tooth preparations, I suggest placing mechanical retentive features, such as pins, potholes, channels or undercuts."

It is quite difficult for all but the most skilled dentist to get resin-based composite to go into small holes or channels. It is very likely that the dentin bonding agent will fill most of these "retentive areas." I cannot find clinical or laboratory data that demonstrates that the current bonding systems and current resin-based composites are improved with this macro-mechanical retention. The research data to support this recommendation are lacking.

Page 1302: "Some amalgams, especially spherical amalgams, are well-known to cause postoperative tooth sensitivity. Self-etching bonding agents prevent this sensitivity."

Tooth sensitivity related to amalgam restorations is very difficult to study, because most amalgam restorations are not reported as being associated with sensitive teeth at two-week study follow-up appointments.

I searched for literature references to show that "self-etching bonding agents" prevent postoperative sensitivity related to amalgam restorations, but failed to find support for that assertion in the refereed literature. Davis and Overton<sup>13</sup> found some decrease in sensitivity to a direct cold challenge of teeth



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with incomplete tooth fracture after Amalgambond Plus with HPA was used to bond amalgam restorations (20 bonded and 20 pin-retained amalgam restorations observed for one year). We concluded that the remaining dentin thickness was more likely the determining factor for less cold sensitivity with bonded amalgams (the pin channels were 2 millimeters into dentin for the control teeth), rather than the bonding agent.

Summitt and colleagues<sup>1</sup> in their six-year study did not find a difference in thermal sensitivity between pin-retained and bonded amalgam restorations. Those studies should not be extrapolated to include self-etching primers, since the 4-methacryloyloxyethyl trimellitate anhydride system that was used is a total-etch system.

Available clinical studies do not indicate that self-etching bonding agents decrease sensitivity in spherical amalgams.

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1. Summitt JB, Burgess JO, Berry TG, Robbins JW, Osborne JW, Haveman CW. Six-year clinical evaluation of bonded and pin-retained complex amalgam restorations. *Oper Dent* 2004;29:261-8.

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3. Tay FR. Reducing steps in dentin bonding-what have we really gained? The Buonocore Memorial Lecture. Paper presented at: Annual Meeting of the Academy of Operative Dentistry; Feb. 24, 2005; Chicago.

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5. De Munck J, Van Landuyt K, Peumans M, et al A critical review of the durability of adhesion to tooth tissue: method and results. *J Dent Res* 2005;84:118-32.

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adhesive in class V resin composite restorations (abstract 233). *J Dent Res* 2001;(special issue) 80:65.

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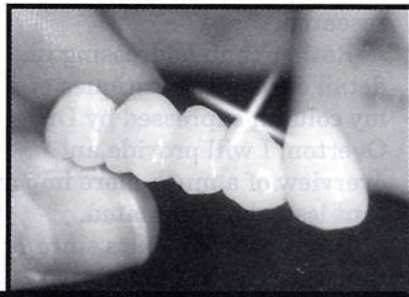
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**Author's response:** I appreciate Dr. Overton taking the time to critique my comments, and I respect his views. I welcome the comments of readers, and often agree with them. However, this letter has stimulated a few comments of my own relative to "in vivo" research, "in vitro" research, clinical observation and the state of so-called "evidence-based" research.

Rather than addressing in detail each of the critiques of my column expressed by Dr. Overton, I will provide an overview of a much more important issue he stimulated.

It has been 41 years since I, too, was "Head of Operative Dentistry" for the first time, and much has happened to mellow my acceptance of in vitro research projects and semiclinical in vivo projects that are conducted in a manner not related to the required speed of actual clinical practice. Many years ago, while attempting to climb the academic ladder with publications, I was engrossed with simply and rapidly accomplishing in vitro research, and I was generally impressed with my ability to "prove" the apparent reliability of concepts and techniques through laboratory research and clinical studies, accomplished at a meticulous and nonclinically practical pace.

Later, after attending two graduate schools, conducting many research projects and receiving a receiving a significant statistical education (I actually taught statistics for a while), I

found I could "prove" almost anything by manipulating the research protocol in the right way and adapting the most lenient statistical programs to the data. I could probably relate the color of socks you wear to be statistically significant to the length of your finger. I then taught scientific method and writing, and had to select projects out of the literature for critique. A couple of the hundreds of classic examples of misleading research are:

Circa 1975: The in vitro two- and three-phase wear studies in the scientific literature repeatedly showed that Adaptic (Johnson & Johnson Personal Products; Skillman, N.J.), a large filler particle size resin-based composite, had superior wear characteristics to the product Isopast (Ivoclar Vivadent; Amherst, N.Y.), a then new silicon-dioxide filled microfill. A large-scale clinical in vivo project we at Clinical Research Associates (CRA) and then many others accomplished showed the reverse when observed in the mouth—microfills were less. In other words, the "scientific" statistically significant literature presented in vitro data that was diametrically opposed to what really happened and what clinicians observed.

Circa 1979-1990: The in vitro scientific literature showed that polycarboxylate cements had far better physical properties than the then commonly used zinc phosphate cement. Unsuspecting clinicians, trusting the "scientific literature," changed to polycarboxylate. Seven to 10 years later, many of the polycarboxylate-cemented restorations "fell off." Again, in vitro data misled thousands of practitioners.

Now, let's move to present time. Every project in our research group, CRA, undergoes careful basic science research, followed by "real world" use and critique by clinical practicing dentists. Our own in vitro data show that several current dentin-bonding agents have mature, thermally cycled bonds to dentin ranging from 30 to 50 megapascals, while the respective enamel bonds with the same materials are only 20 to 30 MPa.

If I believed our own in vitro data to be clinically significant, I would say dentin bonds are stronger than enamel bonds. How wrong I would be! Any experienced clinician who has cut off a ceramic veneer bonded to enamel knows he or she cannot get it off without cutting it from the enamel. The same clinician cutting a veneer from a dentin surface finds the moment the rotary instrument touches the tooth, the veneer flips off. In other words, again the "scientific, in vitro" research, including our own, would mislead me.

My candid opinions at this time about judging whether research reported in the literature should be applied to evidence-based practice are as follows:

■ In vitro research provides interesting and occasionally clinically applicable data, but anyone relying on it for guidance in clinical practice must be widely read and clinically experienced enough to interpret it. Additionally, in vitro research must be backed up with clinical data in order to have any practical value.

■ In vivo research is useful only if the investigators are clinically competent in a pragmatic manner, knowledgeable about popular clinical techniques and able



to relate their clinical procedures to adequate practice management concepts. In my opinion, clinical research accomplished at a slow, nonfinancially practical level is of academic interest only, and is often misleading to practitioners.

■ In vitro or in vivo research funded by companies or individuals with vested financial interests is often justifiably highly suspect and must be backed up with independently funded, clinically relevant, financially practical research. Unfortunately, we often see such biased research published in "peer-reviewed" journals.

In my opinion, some of the most reliable and useful clinical research in dentistry over the past half-century has come from clinical study clubs with clinically competent, research-oriented members who can document actual clinical success or failure with statistical support.

After nearly five decades of teaching, research and practice in dentistry, I am often appalled at some of the nonsense published in the dental literature

and its minimal value to the profession. Such reports only illustrate the lack of clinical knowledge and actual long-term clinical experience of the investigators.

To sum up this tirade Dr. Overton stimulated: true, reliable, evidence-based research must have independently funded, multisource, preferably long-term clinical research; some in vitro research to predict or interpret clinical findings; and assurance that the investigators are honest, competent, nonbiased and nonfinancially oriented. Unfortunately, precious few such studies exist in the literature.

Ask any observant practicing dentist to respond to Dr.

Overton's comments about my column. To state an old adage, "The proof is in the pudding."

"Clinical success is the final test" is a statement on every CRA Newsletter. Dr. Overton's statements about some of my "observations" in the recent column on bonding need significant observation and comment from real-world practicing dentists, not a smattering of miscel-

laneous "data" that anyone can find on PubMed.

I welcome the chance to discuss Dr. Overton's specific beliefs and questions with him, and to compare them with both clinical and laboratory research and, more importantly, to discuss how clinical observations verify or refute the "literature." Evidence-based dentistry requires mature interpretation of apparent or alleged truths. Often, investigators have good intentions, but lack the pragmatic clinical judgment to interpret their findings.

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#### A GOOD READ

If I read only Gordon Christensen's Observations" in JADA, such as his December "How to Kill a Tooth," (JADA 2005;136:1711-3), it would be well worth my reading.

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