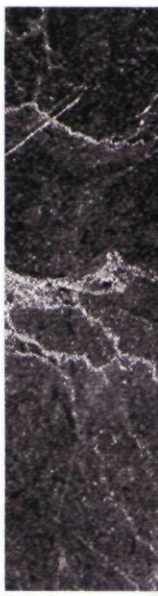

Perspectives

THE ENIGMA OF DENTAL AMALGAM

Posterior composites have made their entrance onto the list of restorative materials commonly used by today's clinician. They have become so popular that some clinicians use them exclusively at the expense of amalgam. The acceptance of this esthetic type of restorative system can be attributed to a major improvement in the materials themselves as well as better techniques for placing them. Clearly, posterior composites when properly placed can be excellent restorations because of their conservative and adhesive nature. These qualities make posterior composites a logical choice, in particular, for the restoration of small incipient carious lesions. Trust me, I have spent much of my professional life researching posterior composites and am well aware of their merits. However, I cannot ignore the simple fact that in spite of its foibles (it is unesthetic, does not bond to tooth structure, and so on), amalgam still is a forgiving friend that, of late, has been overly maligned.

The conversion to composite resins as an amalgam substitute has been slow in developing, but the critical decision to use them exclusively has already been made in many practices. Yesterday everyone hated them. Today everyone loves them. And according to conversations and messages on popular Web-based chat rooms, those who have been converted to this way of thinking are stronger in their beliefs than ever before. It is many of these individuals who make a case for the wholesale use of composite resins in Class II cavity preparations. In addition, many of them vilify and condemn amalgam, not only as an unesthetic material, but also as one that possesses the potential for toxicity and adverse biologic reactions.

Although posterior composite resins (PCRs) offer a great number of advantages over amalgam restorations when used under the same conditions, all is not really as grand and wonderful as some of our colleagues have been trying to make us believe. In this regard, I thought that it might be appropriate to discuss the matter of amalgam versus composite resin in a different light. In doing so, I would like to play the devil's advocate and make a number of points:

- Proficiency. Virtually 100% of those graduating from dental school can successfully generate an amalgam restoration. The vast majority of these individuals can produce a restoration with an anticipated longevity of at least 5 to 10 years. What percentage of these clinicians can place a PCR with an expected longevity of 5 years or, for that matter, 1 or 2 years? In fact, what percentage of clinicians practicing for the past 20 years can successfully place a PCR? Regrettably, not 100%.
- Experience. Placement and completion of a composite resin restoration in a Class II cavity preparation is considerably more difficult than placement of a corresponding amalgam. The differential in difficulty is reduced considerably with an appreciable amount of experience.
- Technique sensitivity. By comparison, the use of composite resin in a Class II preparation is substantially more *technique sensitive*. The various steps associated with the PCR not only are greater in number but each one requires careful and deliberate attention to detail (acid etching, rinsing, removal of excess

moisture, multiple applications [two or more] of the dentin bonding agent, and light curing). In addition to these critical steps, the clinician also must know when and how to use adjunctive materials such as flowable composites. The potential for problems associated with preparing the matrix also can be greater than that for preparing amalgam. Marginal errors made with any of these variables can lead to a rapid demise of the restoration. Furthermore, since the steps associated with the PCR are greater than those associated with a comparable amalgam, the potential for error is greater.

- Postoperative sensitivity (POS). Historically, one of the most common clinical sequelae associated with the PCR is sensitivity to cold temperatures and/or masticatory pressures. This potential problem can last for several days to weeks and months, or even longer. Although many of the causes for this problem have been explained (eg, C-factor and polymerization shrinkage effects), there are still some mysteries. Amalgam has been so thoroughly investigated that most if not all of the clinical problems associated with this restorative system have been resolved. It is interesting to note that even the best suggested treatment for POS is not fully agreed upon.

  In the case of amalgam, POS can and does occur commonly. However, the etiology is fairly well understood, and it normally is of short duration (eg, 1 to several days until corrosion products seal the margins).
- Absolute moisture control. Owing to the possible contamination from salivary fluids containing various types of protein compounds, proper adhesion of the bonding agent can be influenced substantially or even negated when placing posterior composites. With the development of zinc-free amalgam alloys, salivary contamination does not result in an appreciable degradation. Whereas a rubber dam is recommended for the placement of amalgam, it is actually mandated for the PCR; yet, many dentists do not use a rubber dam, regardless of the material being placed.
- Caries inhibition. It is well known that secondary caries associated with a PCR progresses at a substantially faster rate than it does in conjunction with an amalgam. The dissociated ions of tin, copper, and silver from a corroding amalgam tend to produce bacteriostatic conditions. On the other hand, many composite resins contain TEDGMA or TEGMA, which is added to control the viscosity of the material in the uncured state. Unfortunately, however, these agents actually tend to promote bacterial growth. This characteristic translates into a much greater need for the clinician to perfect the marginal adaptation associated with the PCR.
- The material. An amalgam is an amalgam. Basic differences exist more in handling characteristics than in performance. Composite resins, however, exhibit substantially different resistances to wear. Some are recommended for occlusal surfaces, whereas others are suggested for cervical regions such as abfractions. Furthermore, like amalgam, composites currently are produced with wide variations in handling characteristics.
- The curing method. Marginal adaptation and integrity are readily influenced by the intensity of the light used. The greater the intensity of the curing system, the greater the potential for the shrinkage to occur along the margins, especially if a high C factor exists. Slower curing lights or the use of various forms of soft-start polymerization tend to generate a more homogeneous pattern of contraction and better marginal adaptation with less resultant stress.
- Time. In the case of Class II cavity preparations, composite resins take considerably more time to generate a final restoration than does the corresponding amalgam. The differential can be related to a number of factors including the additional steps associated with the restorative process.
- Knowledge and skill. The PCR requires a different understanding of the cavity preparation recommended for its use. Many of the rules taught for the amalgam

restoration are actually inappropriate for the PCR. Amalgam requires volumetric dimension and mechanical retention. The margins should generally be placed outside the regions with the greatest naturally occurring microorganisms and plaque acquisition. The space at the amalgam-tooth interface (regardless of the age of the restoration) is about 10 to 12 µ. In the case of the PCR, the bonding process actually causes the restoration to become an integral part of the tooth structure.

A final word about amalgam. Many different organizations are doing their best to legislate the end of amalgam as a restorative material. Most of us have read their literature. On the surface the arguments appear somewhat laudable. For example, they discuss the number of milligrams of mercury that can vaporize from the occlusal surface of an amalgam during function. They also discuss concomitant elevations of mercury in the blood and urine when amalgams are inserted and the subsequent reduction in this level when the amalgams are removed. But after reading many of these documents and manuscripts about the potential danger of amalgam, I have come to the conclusion that no authentic bona fide scientific publications have been published that demonstrate any valid relationship between amalgams in the oral cavity and any systemic disease. The US Food and Drug Administration came to a similar conclusion last year in probably the best summary of the evidence regarding the safety of dental amalgam (see <http://www.fda.gov/cdrh/consumer/amalgams>).

I, for one, believe that amalgam will be available to the clinician for quite a few years into the future. Think about it. If amalgam were to be removed as a restorative material any time soon, the profession would experience many serious problems. Readily admitted or not, amalgam has served the dental needs of the public exceptionally well for many years because of its forgiving nature. Although a good number of clinicians in this country are fully capable of using PCR as a substitute for amalgam, the number falls far short of 100%. If you do not believe this fact, just ask those in the endodontic profession who have seen the misuse of PCRs result in an increase in the need for endodontic services. Until this group of dentists catches up with the competent users of PCR, the number of replacements and associated caries will undoubtedly continue to occur at an alarming rate. So, in spite of all its faults and perceived deficiencies, our old friend amalgam may well be with us for years to come as long as we responsibly manage its use and disposal.

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CORRECTION

Please note that the table of contents for Volume 15, Number 6 incorrectly listed the Talking with Patients feature "All Ceramic Crowns" as being on page 382. That feature will appear in Volume 16, Number 2.

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