How to kill a tooth

Endodontic therapy is a major part of general dental practice and a significant income-producing procedure. General dentists report that endodontic therapy is increasing in need. Many practice administration courses stress the importance of making endodontic therapy a fast, easy and effective part of practice, and dentists are eager to accomplish endodontic treatment. Although reports concerning the long-term success of endodontic therapy vary, American dentists seem to be relatively satisfied with the clinical success and predictability of endodontic treatment. Many adults have benefited from at least one endodontically treated tooth. Few dental maladies are as painful as a tooth that needs endodontic therapy, and few dental patients are as pleased with their dental therapy as are those who receive successful endodontic treatment.

However, why are more teeth dying? Why is so much endodontic therapy needed? Is it because more teeth are being heroically saved, or because patients are living longer than in the past and, therefore, retaining more teeth that later need endodontic therapy? Or are we inadvertently killing more pulps with some of the techniques, instruments and materials commonly used today?

This article includes some of the potential ways to kill a dental pulp, based on observations I have made in visits to many dental offices, and on my discussions with thousands of dentists around the world about the clinical methods they use in their day-to-day dental practices.

DENTAL TECHNIQUES POTENTIALLY RELATED TO PULPAL DEATH

Resin-based composite used to restore posterior teeth. I have been told by numerous endodontists that one of the most significant factors related to the increase in need for endodontic therapy has been the popularity of resin-based composite to restore posterior teeth. Without proper use of dentin bonding/sealing materials, it is well-known that Class I and II resin-based composite restorations cause postoperative tooth sensitivity and potential pulpal death. Fortunately, this cause of pulpal death appears to be decreasing in incidence because more practitioners are using desensitizing liquids containing glutaraldehyde or hydroxyethyl methacrylate, resin-modified glass ionomer liners and self-etching primers instead of total-etch primers.[1] These materials seal dentinal canals by impregnating them with resin or coagulate or physically seal dentin. However, because of resin-based composite's known ability to irritate the pulp, there still is resistance on the part of some dentists to using this restorative material in posterior teeth instead of conventional amalgam. Resin-based composite can be used without pulpal sensitivity and subsequent pulpal death when proper bonding agents, liners and

desensitizing solutions are used.

Resin-based composite cement for indirect restorations. In recent years, dentists have reported that their patients have experienced unacceptable postoperative pulpal sensitivity and some pulpal death when total-etch bonding systems were used before resin cements were placed.[2] However, some manufacturers continued to advertise and teach that their resin cements and bonding systems did not produce such ill effects. Apparently, the total-etch primer concept used before placment of resin cement did not predictably provide the necessary dentinal seal to seat crowns or fixed prostheses without producing tooth sensitivity and eventual pulpal death. This unfortunate situation dissuaded dentists from seating restorations with resin cements and from using indirect restorations requiring resin cement. Some popular products, including the first one introduced—Panavia, in its various forms (Kuraray, New York)—had a separate bottle of self-etching primer (in Panavia's case, ED Primer) that had to be used before the resin cement component of the product was placed on the tooth. The Panavia concept dominated the marketplace for several years and was quite successful. Other companies copied the concept, and although strength values and other properties were good with these products, improper use caused occasional lingering postoperative sensitivity, and infrequent pulpal death occurred. On the advent of the self-etching primer–resin cement combination products—Maxcem (Kerr, Orange, Calif.), RelyX Unicem (3M ESPE, St. Paul, Minn.) and Universal Resin Cement (Pulpdent, Watertown, Mass.)—the dilemma was solved.

When use of resin cements is indicated for crown cementation, I suggest that self-etch resin cement products should be used to eliminate the problems described here.

Deeply cut veneer preparations. There is a growing tendency to cut tooth preparations for veneers deeply into dentin.[3] Usually, the veneers are seated with resin cement over bonding agents that are in the total-etch category. Because the ceramic veneer can be made thick, this technique makes matching the desired tooth color easier than when the veneer preparations are cut to a shallow level. However, veneer preparations that are cut deeply into dentin and then treated with total-etch primers can have objectionable characteristics. These problems include postoperative tooth sensitivity, debonding after thermal changes, occlusal stresses while eating and pulpal death. I suggest that veneer tooth preparations should be made in enamel whenever possible. Such preparations do not cause these problems.

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Deeply cut tooth preparations for all-ceramic crowns and fixed prostheses. The growing popularity of all-ceramic crowns and fixed prostheses has created an increase in postoperative tooth sensitivity and pulpal death. Often, to change tooth color, contour or occlusion, these restorations are placed on nearly virgin teeth with large pulps or on young teeth with large pulps and wide-open dentinal canals. These tooth preparations must be at least 1 to 1½ millimeters deep on all surfaces, except the occlusal surface, where the reduction should be 1½ to 2 mm. Such deep tooth preparations on teeth with large pulps require meticulous care to avoid tooth sensitivity or worse effects. Fortunately, some of the alumina- or zirconia-based all-ceramic restorations can be seated with resin-modified glass ionomer cement (such as RelyX Luting Cement, 3M ESPE, or GC FujiCEM, GC America, Alsip, Ill.), which reduces or eliminates postoperative tooth sensitivity. However, to provide adequate strength for pressed ceramic indirect restorations, and to avoid the hygroscopic expansion of the resin-modified glass ionomer cements on these somewhat weaker restorations, the restorations should be cemented with resin-based composite cements. I suggest that pressed ceramic restorations should be cemented with the self-etch primer–resin cements suggested previously in this article to reduce or eliminate postoperative problems.

Occlusion too high on restorations. Fixed prosthodontic procedures are carried out far more frequently now than they were in years past. On many occasions in my practice, I have observed crowns and fixed prostheses, placed elsewhere, that were left in supraocclusion after cementation. I have seen dentists seat fixed prostheses

without checking and correcting occlusal contacts, with the result that the affected tooth or teeth soon become highly sensitive. To avoid the high occlusion, the teeth move in the bone to locations that do not have the same high occlusion. Often, the affected teeth cannot move far enough to get out of the zone of occlusal trauma. The clinical result is a widened periodontal ligament, mobile teeth, painful teeth, open contact areas, chipped ceramic, loosening of implants or implant abutments, and eventual pulpal death of the restored or opposing teeth. In my opinion, clinicians must pay more attention to correcting occlusion when seating comprehensive restorations.

Aggressive or dry tooth cutting and dull rotary instruments. High-speed air rotor handpieces, and especially electric high-speed handpieces, cut extremely rapidly and can cause significant vibration in the teeth being prepared. Also, many dentists do not use significant water lavage when cutting teeth. I have seen teeth develop black burn marks as high-speed handpieces and dull burs or worn-out diamond rotary instruments are used with too much pressure while cutting. How much trauma can a dental pulp take before dying, and how long after cutting a tooth preparation does the pulp die? We don't know. I suggest using new carbide burs for each patient whenever possible and new, single-use rotary diamond instruments for every patient. When using new rotary instruments each time, the clinician has no doubt that the instruments are sharp and concentric. Additionally, I suggest using careful low-load cutting with either air rotors or electric handpieces. These handpieces cut fast and well, even if high cutting load is not used on them.

High exothermic activity in provisional restorations. Try holding an unset piece of polymethyl methacrylate or polyethyl methacrylate in your hand while the specimen sets. You will have to release it as it goes through its exothermic setting reaction. Imagine that same high temperature on a deeply prepared tooth. Pulpal damage is unavoidable with improperly used provisional materials. These materials must be cooled as they are polymerizing. Dental assistants making these types of provisional restorations need to know the significance of high exothermic activity and high pulpal temperatures. I suggest using bisacryl provisional materials for one unit or short fixed prosthodontic situations. These materials do not have a significant exotherm. When the strength and color stability of polymethyl methacrylate is needed, I suggest using a laboratory-made polymethyl methacrylate shell for the exterior of the provisional restoration and a liner made of polyethyl methacrylate, which gives off a lower exotherm, in the mouth for the shell.

Dentist error. In addition to the problems I already have described, numerous other commonly occurring clinical situations could be described that logically should injure or kill the dental pulp. Perhaps we dentists are our own enemies. Perhaps we are one of the major reasons for the increased need for endodontic therapy by virtue of creating deep preparations, leaving dentinal canals unsealed, carrying out traumatic preparations and prematurely abandoning occlusal treatment of restored teeth. Perhaps we are too hasty in accomplishing endodontic therapy on teeth that are sensitive but may become nonsymptomatic if allowed to rest without endodontic therapy for a few more weeks. I feel that is the case.

SUMMARY

Many dentists report increased activity in endodontic therapy. Although retention of teeth through most of life by many patients and the aging population are potential reasons for this increase, it is possible that some of the new dental procedures, instruments or materials that have become popular in recent years also are significant causative factors. Several potential preventable reasons for increased pulpal death and the resultant need for endodontic therapy are discussed in this article. ■

Dr. Christensen is co-founder and senior consultant, Clinical Research Associates, 3707 N. Canyon Road, Suite 3D, Provo, Utah 84604. Address reprint requests to Dr. Christensen.

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