

Caries removal and repair of fractured teeth: Inexact sciences

Complete caries removal has been emphasized for over a century as the primary prerestorative challenge in restorative dentistry. Dentists have been taught to pursue carious tissue relentlessly in an attempt to insure restorative longevity, even when such pursuit means sacrificing pulpal tissue, enamel walls, and unsupported cusps. We have exposed pulps and extended preparations far below gingival margins, through grooves and fissures, and beyond.

Tooth fractures often present equally challenging restorative situations.

Calcium hydroxide in deep preparations has served as a reparative dentin stimulator, and billions of teeth have been saved from extraction as a result of our attempts at caries control, pulp protection, and secondary dentin formation.

And yet we cannot be sure that a *specific* tooth will survive after radical caries removal or deep fracture, and so we wisely equivocate when informing patients about the likely future of such teeth. I have repeated the same warning countless thousands of times over 35 years: "The decay/fracture was deep, and we cannot be sure of the extent of damage that might have occurred to the pulp in your tooth. We have placed a material in the bottom of the cavity that stimulates the nerve to heal if it has not been too badly damaged. If it does not have the capacity to heal, it will die and become infected, and a root canal filling will be required to save your tooth."

When Nakabayashi published his work on the hybrid layer in the early 1980s, a new potential for sealing carious dentin and repairing fractured teeth arose immediately. The dental literature as far back as the 1940s contains numerous studies of the fate of bacteria when they are sealed off from substrate. A meta-analysis of the literature strongly suggests that the carious process is arrested under a complete restorative seal. Such a seal was difficult and somewhat unpredictable in the past.

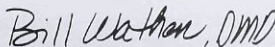
A similar look at treating fractured teeth reveals equally fascinating repair potential.

Buonocore's landmark paper on etching enamel prior to placing acrylic restorative materials began a remarkable 45-year period in restorative dentistry. Building on that discovery, Nakabayashi's work presented the possibility for a better, easier, more predictable seal of etched enamel and dentin with resin composite materials.

Much has been written about the idea of sealing carious dentin deliberately not removed during the restorative process, and of etching, sealing, and reattaching fractured tooth segments. While there is no indisputable evidence of predictable success, papers like those of Ribeiro et al (page 591) and Worthington et al (page 637) add to the growing body of evidence that with proper use of modern adhesive systems, tooth structure can be saved and caries can be arrested with greater assurance of success than ever before.

As has been cautioned many times, adhesive dentistry is more demanding and technique-sensitive than our metal-based techniques of the past. At the same time, however, it offers a better potential for true restoration. A number of excellent texts should be added to our "must-read" list. Some suggestions are listed below.

In summary, in the case of caries, tooth preparations prior to adhesive restoration can be conservative and free-form compared to past techniques. In the case of fractures, we have numerous new possibilities for successful repairs without radical interventions such as extraction/bridge and endodontic therapy/post/core/crown. As the millennium approaches, we have wonderful therapies to offer our patients. As dental demand changes from the need-based orientation of treating pain and infection to the want-based focus on health, form, function, and esthetics, the future of dentistry has never looked brighter.



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Suggested reading

- Baratieri LN, et al. *Advanced Operative Dentistry*. Chicago: Quintessence, 1993.
- Baratieri LN, et al. *Esthetics: Direct Adhesive Restorations on Fractured Anterior Teeth*. São Paulo: Quintessence, 1998.
- Nakabayashi H, Pashley DH. *Hybridization of Dental Hard Tissues*. Chicago: Quintessence, 1998.
- Schwartz RS, Summit JB, Robbins JW. *Fundamentals of Operative Dentistry: A Contemporary Approach*. Chicago: Quintessence, 1996.