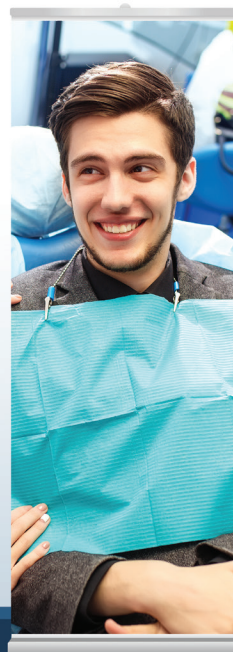


**AN INTRODUCTION
TO PULP CAPPING**

When pulp is at risk of necrosis—either the pulp is fully exposed or nearly exposed—clinicians can preserve it through the process of pulp capping. There are two types of pulp caps—direct and indirect—and when done properly and under the right circumstances, pulp can not only be preserved, but dentin can be regrown.

3 Ways Pulp Cap Breakthroughs ARE MAKING PATIENTS'— AND DENTISTS'— LIVES BETTER



Dr. Gary Alex, DMD, a general dentist in Huntington, N.Y., explains the distinction between direct and indirect pulp capping.

“Direct pulp capping is used when the pulp is visibly exposed (vital pulp exposure) due to caries, trauma or iatrogenic insult such as accidental exposure during tooth preparation or caries removal,” he explains. “Indirect pulp capping is generally used in deep cavity preparations that are in close proximity to the pulp, but with no visible exposure. Of course, the success of both direct and indirect pulp capping procedures is contingent on the health and vitality of the pulp complex to begin with. Teeth that have a history of unprovoked spontaneous pain, necrotic or partially necrotic pulps, radiographic pathology, or excessive hyperemia on pulp exposure due to inflammation, have a poor prognosis with pulp capping and typically will require endodontic intervention or extraction at some point.”

“Historically, at least in the case of direct pulp capping, calcium hydroxide or calcium oxide products such as Dycal have been considered the gold standard,” Dr. Alex says. “However, this is changing and other newer, less soluble and better sealing products that are MTA-based or have MTA-like characteristics may be a better alternative. The ultimate goal of any pulp capping procedure is to manage bacteria, stimulate pulp cells to form new dentin, and to provide a biocompatible

and durable seal to protect the pulp complex from bacteria and noxious agents.”

Hand-in-hand with pulp capping products is utilizing the proper technique. Dr. Thomas Dudley, DMD, a cosmetic dentist in Alabama, explains the process he uses when pulp capping.

“I always have a rubber dam and then I will go ahead and clean it, if there is some bleeding,” Dr. Dudley says. “It’s always recommended to use 10 percent sodium hydrochloride, rinse the tooth, lightly dry, leave it a little bit moist, place your pulp cap in the area that covers all the exposure, plus some of the dentin, light cure it, and then we come back and you can use a total-etch, self-etch or selective etch technique and then bond your resin right over the top of it, or your build-up material if you’re doing a crown.”

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– Dr. Gary Alex, DMD, general dentist

LIGHT-CURING

Many pulp capping materials require mixing of two components and some have long set times. The ability to set pulp capping agents on demand via light-curing can save significant time when performing pulp capping procedures.

“One of the best pulp capping agents, as far as immediate response, has been calcium hydroxide,” Dr. Dudley says. “Calcium hydroxide has drawbacks in that it is soluble. It’s

great for six months to a year, but over the long term, if you don't get that repair to dentin formed, it kind of dissolves and goes away."

The next best option, Dr. Dudney says, is MTA—mineral trioxide aggregate. However, a long curing time made MTA difficult to use. BISCO's TheraCal LC® was developed with light curing in mind and is a good solution to this problem.

"MTAs have a lot of value in dentistry, as far as apical seals and root preparation repairs, endodontic access closing, things like that," Dr. Dudney says. "For me, clinically, the reason I like TheraCal LC® so much, is because of the light cure capability. I can place it over the pulp cap, cure it with a light, and then immediately go ahead and restore the tooth, and not have to wait an extensive amount of time for the self-cure mechanism to kick in."

"In the case of direct pulp capping I think the MTA-based products such as ProRoot MTA and hybrid resin/MTA materials like TheraCal LC® are an exciting, and in my mind, better option than traditional calcium hydroxide," Dr. Alex says. "In fact, right now my material of choice in the case in direct pulp capping and near pulp exposures is treatment of the area with an anti-microbial solution followed by a thin layer of TheraCal LC®

that is then overlaid with a resin-modified glass ionomer. TheraCal LC® is really a new class of material that I would classify as a light-cured resin modified calcium silicate. It is basically a blend of MTA and various hydrophilic and hydrophobic monomers. A study by Gandoffi and colleagues found TheraCal LC® displayed

higher calcium-releasing ability and significantly lower solubility than either ProRoot MTA or Dycal and had better physical properties. One huge advantage TheraCal LC® has over MTA (which has a long set time) is the ability to set on command via light polymerization."

SEALING

Sealing the tooth is critical for both forming apatite and managing bacterial

infiltration. Whenever the pulp is exposed, it is at the greatest risk for bacterial ingress, and both materials and the clinician's technique is needed to defend against that risk.

"Once you get into a cavity preparation and the pulp's exposed, or nearly exposed, there's generally lots of bacteria present," Dr. Alex says.

"The reason I like TheraCal LC® so much, is because of the light cure capability. I can place it over the pulp cap, cure it with a light, and then immediately go ahead and restore the tooth, and not have to wait an extensive amount of time for the self-cure mechanism to kick in."

— Dr. Thomas Dudney, DMD, cosmetic dentist

"One of the first things the dentist should be concerned with is managing that bacteria."

Dr. Alex's personal preference when bonding to deep dentin is to clean the substrate with a 2% aqueous solution of chlorhexidine digluconate (Cavity Cleanser™ by BISCO or Concepsis® by Ultradent).

"Of vital importance in any pulp capping procedure is the provision of a seal that protects the pulp complex from the external environment," Dr. Alex states.

"The pulp may be a far more resilient tissue than many believe, providing it is healthy to begin with, bacteria is managed, and an environment and durable seal can be created utilizing materials conducive to the pulp's continued health."

Materials, such as calcium hydroxide, may not be the best at providing a long-term seal.

"Initially the seal was pretty good, and a calcium release was good," Dr. Dudney says. "The problem was is that it's soluble, and when exposed to fluids, which anytime you're covering pulp or dentinal tubules, you're going to be exposed to fluids, it would literally wash away. If you put down something over the tooth that doesn't wash away, that is insoluble, and it actually seals that area and prevents bacteria from ever getting into the pulp, that's a major advantage. Both MTA and TheraCal LC® have the ability to do that."

ANATOMICAL ENHANCEMENTS

In addition to preserving healthy pulp, pulp capping also promotes the regrowth of dentin. This is made possible by the release of calcium ions and the resulting formation of apatite.

"Pulp capping materials like calcium hydroxide, MTA, and TheraCal LC®, have certain commonalities" Dr. Alex says. "They all tend to have a high pH (generally between eight and 12), and release calcium (Ca²⁺) and hydroxide (OH⁻) ions creating an alkaline environment that may stimulate undifferentiated pulp cells to differentiate into odontoblasts that subsequently produce reparative or tertiary dentin."

"That's why calcium hydroxide has always been used in pulp capping," Dr. Dudney says. "There are other products that don't release calcium that just kind of seal the pulp and prevent that ingress. I think most experts will tell you the ability to form a calcium bridge and reparative dentin is advantageous as well as sealing the pulp. It's a combination. If you can seal the pulp and prevent bacteria from getting into the dentinal tubules, that's certainly going to be advantageous."

Pulp capping is not a new technique; however, with newer materials, it is easier and effective, resulting in value for both the clinician and the patient.

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