

QUESTION 2

Some of my patients are still having problems with dentinal hypersensitivity, even after conventional treatment. Are the new oxalate desensitizing agents the answer?

Background

Dentin hypersensitivity, associated with either a restoration or exposure of the root surface, is caused by the rapid movement of fluid in the dentinal tubules. This phenomenon was first described as the hydrodynamic theory of dentinal pain by Brannstrom,¹ who attributed the fluid

flow to osmotic stimuli. It is widely accepted that this rapid flow of fluid creates a pressure change across the dentin, which stimulates the nerve fibres and results in the perception of pain.² It is therefore no surprise that the accepted treatments focus on occluding the dentinal tubules by various precipitates or covering the exposed dentin with an impermeable layer to prevent the osmotic gradient changes that create the painful stimuli.

Many products are available to decrease the sensitivity caused by exposure of the cervical dentin. One category of products consists of desensitizing toothpastes containing potassium nitrate, which penetrates the dentinal tubules and depolarizes the nerves, decreasing the painful stimulus.³ Potassium nitrate gels that can be used in bleaching type trays for hypersensitive root surfaces include UltraEZ (UltraDent, South Jordan, Utah), Den-Mat Desensitize (Den-Mat, Santa Maria,

Calif.) and Relief (Discus, Culver City, Calif.). Another type of product is based on the fact that sclerotic dentin has dentinal tubules that are completely occluded by mineral deposits. To produce a similar clinical situation, fluorides are applied topically, creating precipitates of calcium fluoride, which can close the dentinal tubules.

Products containing glutaraldehyde also work well for desensitization. Glutaraldehyde is an effective disinfectant. It kills bacteria and coagulates the plasma proteins within the dentinal fluids, forming a coagulation plug. Gluma Desensitizer (Heraeus Kulzer, Armonk, N.Y.), 5% glutaraldehyde with 35% hydroxyethylmethacrylate (HEMA) and water, is effective as a desensitizing agent under restorations and does not interfere with the bonding of resins to dentin. However, glutaraldehyde can be irritating to the soft tissues and should be used sparingly; it is applied with a microbrush, and the area is blotted to remove any excess. Hanks and others⁴ reviewed the cytotoxic properties of glutaraldehyde, and Li and others⁵ discussed its mutagenic potential. Like all products containing HEMA, glutaraldehyde can cause contact dermatitis, and it penetrates latex gloves.⁶

By their very nature, the many different types of dentin bonding agents currently available constitute a class of desensitizing agents because they form a hybrid layer. These bonding agents include total-etch 1-bottle and multi-bottle systems, and self etching 1-bottle and 2-bottle systems.

Current Status of Oxalates

Whether used to treat exposed cervical dentin or exposed dentin under a restoration, application of oxalate desensitizing materials to the dentin results in precipitation of potassium oxalate or ferric oxalate crystals. Materials like Protect Drops (John O Butler, Chicago, Ill.) and Sensodyne Sealant (GlaxoSmithKline, Research Triangle Park, N.C.) are designed for application to exposed cervical dentin. Potassium oxalate has been used to occlude open tubules in sensitive cervical dentin, causing "instant sclerosis" of the tubules.⁷

Intended for use under direct and indirect restorations, Super Seal (Phoenix Dental, Fenton, Mich.) is a potassium salt of oxalic acid; combined with water, it creates a calcium oxalate precipitate on the dentin, which affects the bond strength of

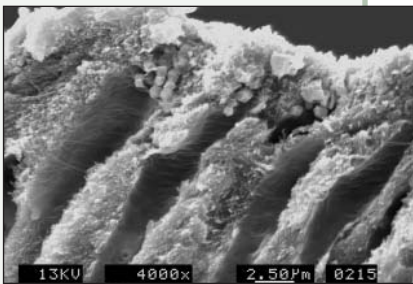


Figure 1: Scanning electron micrograph of typical deposition of oxalate crystals on the dentin surface. Courtesy of Dr. David Pashley.

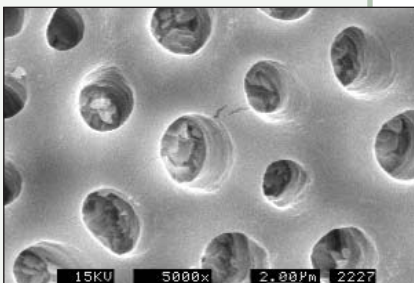


Figure 2: Scanning electron micrograph of oxalate crystals that have precipitated in dentinal tubules. Courtesy of Dr. David Pashley.

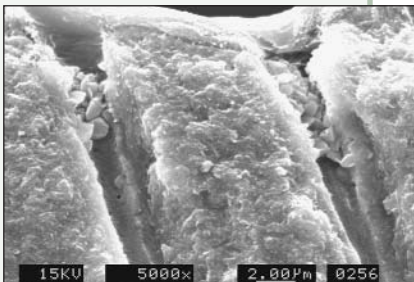


Figure 3: Scanning electron micrograph (lateral view) of dentinal tubules, showing deposition of calcium oxalate crystals. Courtesy of Dr. David Pashley.

Table 1 Shear bond strength of various bonding agents in the presence of BisBlock and Super Seal

Bonding agent	Mean shear bond strength (standard deviation) (MPa)		
	Control	With Bisblock	With Super Seal
One-Step	21.77 (0.49)	23.06 (3.80)	23.14 (1.59)
Single Bond	22.64 (1.61)	22.38 (2.96)	11.34 (6.02)
Solo Plus	20.04 (2.23)	10.60 (3.67)	7.30 (2.25)
Prime Bond NT	14.96 (5.44)	7.30 (2.87)	8.64 (5.52)
Excite	17.99 (1.03)	7.38 (3.35)	3.82 (3.89)
All-Bond 2	23.59 (2.95)	20.57 (3.19)	9.54 (4.71)

Single Bond (3M ESPE, St. Paul, Minn.); Excite (Ivoclar Vivadent, Amherst, N.Y.); All-Bond 2 (Bisco)

any dentin bonding agents used over it. With OptiBond Solo Plus (sds/Kerr, Orange, Calif.) and Prime & Bond NT (Dentsply), bond strength was much lower than with a control agent.⁸ In their newsletter,⁹ Clinical Research Associates, Inc. reported that “Super Seal reduced bond strengths significantly for 5 out of the 6 adhesives tested.” In contrast, BisBlock (Bisco, Schaumburg, Ill.) oxalate desensitizer uses a unique patented approach for sealing the dentinal tubules,¹⁰ whereby the dentin is etched before application of the oxalate. Removal of calcium from the reactive surface creates a preferential deposition zone for the calcium oxalate crystals within the dentinal tubules, not on the dentinal surface (Figs. 1 to 3). When BisBlock is applied to the root surface, this deposition within the tubules prevents dislodgement caused by toothbrush abrasion.

It is of utmost importance to remember that many desensitizing agents affect the bond strength of the adhesives that we use every day. Specifically, oxalate desensitizers yield low bond strengths when used with low pH (highly acidic) adhesives. Table 1 shows that not all total-etch adhesives are compatible with oxalate desensitizers. For example, only One-Step (Bisco) is universal, working equally well with both BisBlock and Super Seal. ♦

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