No more ice cream. Forget about ice in your drinks (and you’ll probably feel better if you use a straw). Make the hot drinks lukewarm and stay away from sweets. No more mouth breathing in cold weather and, whatever you do, don’t touch that area! Have you ever suffered from dentin hypersensitivity? Does it feel like root sensitivity is controlling your life or the lives of your patients?

Since so many people simply live with sensitivity, we don’t really know how many people are affected by it, but estimates put it at approximately 35 percent of the general population, with figures ranging between four and 57 percent. It is estimated that 60 to 98 percent of periodontal patients with exposed dentin are the largest group of sufferers, followed by those who whiten their teeth. My guess is, someone on your team probably has root sensitivity.

Pain is caused by the movement of fluid within the dentinal tubules, otherwise known as the hydrodynamic theory. Dентinal tubules contain a plasma like fluid that conducts impulses from the outside surface back to the fibers of the pulp. Movement of the fluid causes stretching or compressing of the nerve fibers, triggering pain. The dentinal tubule can be open at both ends, in the mouth and at the pulp. Researchers have determined that sensitive teeth have approximately eight times the number of tubules in a given area compared to non-sensitive teeth and the diameter of these tubules is nearly twice that of tubules found in non-sensitive teeth.

To put this in perspective for patients, use the straw analogy. Grab a handful of different size straws, big ones for cold drinks and small ones for cocktails or coffee. Dентinal tubules come in a variety of diameters, just like straws. Now imagine 30,000 straws – that’s how many dentinal tubules can be found in one square millimeter of dentin. Your handful of open straw ends represent the open dentinal tubules on an exposed root surface. Unlike your empty straws, each dentinal tubule is filled with a plasma-like fluid which represents 22 percent of the tooth’s fluid. Additionally, an odontoblast process and nerve fibers extend into each dentinal tubule from the pulp. Whatever touches the ends of those straws will impact the fluid inside, transmitting the stimuli to the nerves via movement of this fluid and sending signals to the other end – in the tooth, that’s the pulp. Hot, cold, touch, dehydration and chemicals that cause osmotic changes can impact the fluid inside the straw or tubule. To prevent stimulation of the fluid in the straws, we simply block the end of each straw. This can be done by a coating over the end, like plastic wrap, or using something that actually enters the straw and plugs the ends, like a cork. Another approach is to use a substance that enters the straw and numbs up the nerve.
Normally, cementum blocks the tubules, but it is soft and thin at the cemento-enamel junction and can easily be removed, leaving the tubules open. Without cemental protection, increased fluid flow will fill the dentinal tubules 10 times each day. When dry absorbent paper is placed on a sensitive root surface, fluid is drawn outward and pain is felt. If a moist paper is placed instead, no pain is felt. A question yet unanswered is what effect does blocking dentinal tubules have on the normal flow of fluid within dentinal tubules.

Natural occlusion of open tubules occurs through calculus formation and the deposition of salivary crystals, which explains why sensitivity increases after periodontal instrumentation. In office and at home therapeutic agents either enter the tubules and modify the neural response of the pulp or form crystals within the open tubules that reduce the size of the opening or close it completely. In both cases, pain is reduced.

Laboratory studies that measure the effectiveness of therapeutic hypersensitivity agents are done by microscopically measuring tubule-opening sizes on extracted teeth before and after application of a desensitizing agent. Theoretically, this information provides proof of product effectiveness. Another laboratory approach uses a silicone rubber impression material to reproduce the dentinal surface for evaluation by scanning electron microscopy. This approach was perfected on extracted teeth in the laboratory and then impressions were made in the mouth on teeth with sensitive cervical root surfaces prior to extraction. Subjective hypersensitivity testing by the patients prior to tooth extractions correlated with the number and size of tubule openings captured in the impressions and on the actual root surfaces.

Replicating conditions in the mouth for laboratory studies is difficult, so studies are done by imbedding root chips with open dentinal tubules into dentures. After test periods of seven days to a month, the chips are removed and evaluated under a scanning electron microscope. This method is used to measure the length of time dentin tubules remain occluded following various hypersensitivity treatments. It can also measure the natural crystal formation that occurs with saliva.

In real life, clinicians must rely on the patient’s response to a pain stimulus, usually cold air or touching with an explorer. Surprisingly, many with root sensitivity don’t mention it, as they think nothing can be done to treat it. In many cases sensitivity is discovered while examining or treating the teeth.

Over instrumentation of root surfaces is a common cause of root sensitivity and measurements show a doubling of root sensitivity following periodontal surgery. Applying desensitizing agents at the time of surgery is an effective way to prevent post surgical sensitivity.

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The popularity of tooth whitening has increased the incidence of sensitivity so providing a desensitizing treatment either before or after whitening will reduce pain. Many new whitening products now contain ingredients to control sensitivity at the same time.

Diagnosis of root sensitivity should rule out endodontic infections, caries, cracks, chips or broken fillings. When determining the etiology of individual hypersensitivity cases, oral hygiene, parafunctional habits and diet should be evaluated. Sensitive areas need to be kept free from bacterial biofilm with daily oral hygiene. Parafunctional habits like clenching, grinding and mouth breathing should be evaluated. Dietary habits that decrease oral pH need to be addressed as high acid foods, beverages including fruit juices, energy drinks and wine, pickled foods and sour acid candies all have erosive effects that can lead to loss of mineralization thus opening dentinal tubules and causing sensitivity. Toothbrushing after ingestion of low pH foods and beverages has been shown to remove softened enamel and cementum. Eating disorders causing vomiting and some occupations, like wine tasting, and excessive use of acidic medications like vitamin C or aspirin can be causative factors for dentin hypersensitivity.

Treatment for dentin hypersensitivity should include patient counseling regarding oral hygiene, parafunctional habits and low pH foods and beverages. Products and treatments are categorized into three levels. The first and easiest is the use of a toothpaste designed for sensitive teeth. An increasing number of sensitivity toothpastes are now available over the counter to consumers. The most popular ingredient in sensitivity toothpastes is potassium nitrate, which was first studied as a treatment for dentinal hypersensitivity in the late 1960s by Dr. Milton Hodosh. Potassium nitrate works not by blocking dentinal tubules, but by action similar to a local anesthetic. Increased concentration of extracellular potassium ions result in depolarization of the nerve fiber membranes, thus interfering with signal transmission to the pulp. Elimination of dentin hypersensitivity with toothpaste will take daily use for two to three weeks plus continued use over time to prevent recurrence.

NovaMin is a new ingredient used in both toothpastes and professional treatment products. NovaMin was invented by researchers at the University of Maryland Dental School, as an outgrowth of bone regeneration work. Each microscopic NovaMin (calcium sodium phosphosilicate) particle serves as a delivery system for mineral ions that combine with naturally occurring ions in saliva to form hydroxyapatite crystals, that close dentinal tubules and remineralize enamel.

If one of the sensitivity toothpastes doesn’t relieve the pain, the next step is a clinician-dispensed product for use at home. These products include high-level fluoride pastes and gels, usually 5,000ppm.

Professional treatments include paint-on and light cured products, lasers, surgery and restorative options. The most popular paint-on products have traditionally been fluorides, including fluoride varnishes. Other paint-on products use metal salts to occlude the tubules, including aluminum, potassium and ferric oxalates. Polishing pastes used by dental hygienists are now available with ingredients to immediately block dentin tubules, thus allowing further instrumentation. Colgate recently introduced Sensitive Pro-Relief desensitizing polishing paste containing Pro-Argin technology consisting of arginine and an insoluble calcium carbonate that effectively forms crystals to block the tubules with two-three-second applications (this product was previously available as ProClade).

Dentsply’s new polishing paste, NUPRO NUSolutions, contains NovaMin, allowing for the blockage of tubules to immediately relieve sensitivity. A normal prophylaxis using these new polishing pastes for relief of dentin hypersensitivity transforms a routine procedure into one that is now therapeutic.

Another paint-on option is the methacrylate polymers used to seal cavity preparations or as composite bases. Next are the oxalate and glutaraldehyde products. Light cured resins provide another option that requires more clinician time but results in sealing the open dentin tubules.

When localized dentin hypersensitivity doesn’t respond to therapies already discussed, more invasive procedures are considered, including Class V restorations, gingival grafts, iontophoresis (delivering a low voltage charge force of sodium fluoride into the dentin) and laser therapy.

When dentin hypersensitivity is diagnosed early, before significant recession, minimally invasive therapy options have the best chance of success. Over the counter toothpastes and office dispensed sensitivity products are the place to start, together with in-office polishing pastes and paint-on desensitizing solutions. Long standing sensitivity with extensive recession may require surgical intervention to cover the exposed root surface with grafting material to protect the open dentin tubules. Many options are now available to treat dentin hypersensitivity. Patients and dental professionals who suffer with dentin hypersensitivity have many new products and approaches to eliminate the problem once and for all. Bring on the cold drinks and ice cream!