It was believed in the early 17th century that mineral water found in natural springs had curative powers and that drinking it would lead to good health. Early scientists soon discovered that the bubbles or carbon dioxide in this healing water was the purported cure.

The soft-drink manufacturers soon began to manufacture beverages called soda, pop or coke with flavors and carbonation in the same assumption that by drinking this bubbly natural water or carbonated beverage, the person would enjoy great health. Because drinking either natural or artificial water was considered a healthy practice, where did we go wrong?

Let's examine a few questions regarding carbonated beverages and the acid erosion dilemma that we see today in our dental practices.

*How did carbonated beverages go from a healthy drink to an unhealthy drink? Is it possible that our patients can be suffering from soda sensitivity because of acid erosion caused by the ingredients in these beverages?*

This might be a question we need to ask during the assessment phase of our patients' initial dental visits. With the staggering statistics and data compiled in the last 10 years regarding our consumption of soda, the assessment of our patients for the drinks they consume should perhaps be a standard question on the dental patient assessment form.

The commercial sale of soft drinks has increased by 56 percent over the last 10 years and is estimated to keep rising at about 2 to 3 percent a year. According to current research, acidic beverages are thought to increase the potential for dental erosion, which is defined as the chemical removal of mineral from the tooth structure. Erosion is typically progressive and results in the wearing away of the exposed tooth surface.

The question then remains, should we be assessing our patients for soda sensitivity and soda consumption during their initial dental visit? Is it possible that our patients can be suffering from enamel erosion leading to dentinal or enamel sensitivity?

With different names for carbonated beverages, are the ingredients the same?

Historically, the word “soda” refers to the beverages produced by dissolving carbon dioxide gas in plain water and has been around since the 18th century. The term “pop” was introduced in 1812 as manufacturers added nectar to soda water. In 1890, entrepreneurs developed alternative drinks based on cola and sarsaparilla extracts with carbonation. Because these drinks were believed to have medicinal properties, “soft drinks” exploded onto the market with many different flavors, including lime, lemon, orange and many variations.

Today we know these beverages with a wide variety of names, all of which are considered carbonated beverages. The ingredients in these beverages in-
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includes flavorings, water, sweeteners, sugar, non-nutritive sweeteners, acids, citric acid, phosphoric acid, carbon dioxide, sulfur dioxide, coloring additives and preservatives. The soda pop of today contains many ingredients, but it is the phosphoric acid that can lead to acid erosion. Why is phosphoric acid necessary in soda?

In order to understand the soda connection to dentinal hypersensitivity, let’s first consider the chemicals in soda that can attribute to tooth sensitivity. As discussed in the previous question, carbonated beverages contain many ingredients, but the acids are added to buffer the beverage and offset the sweetness of the sugar.

Phosphoric acid is an acidulant, i.e. a substance added to food and beverages to lower the pH and to give it a tart, acidic taste. Phosphoric acid along with carbon dioxide is added to retard the growth of molds and bacteria that can grow in a sugary soda solution. Phosphoric acid is also added to keep the carbonated bubbles from going flat.

With many different beverages on the market, what is the difference between the pH of these beverages?

The pH of a beverage will range from a pH of 0, which is very acidic, to a pH of 14, which is very basic. A pH of 7 is our typical value for neutral. The pH of water is around 7, while the average soda pH is around 3 and sometimes less. Most carbonated beverages have a pH of 2.5 with the diet colas on average around 3.3.

Studies done on acidic foods and beverages as risk factors for enamel erosion reported that most acidic beverages at a pH level of 4.2 is minimal, but became more evident as the pH was lowered. This low pH solution bathes the tooth continually and can potentially cause dentinal hypersensitivity because of the dental erosion.

How can soda lead to dentinal sensitivity?

The exposure and bathing of the tooth to acid over a long period can cause a progressive loss of enamel and eventually dentin. If the patient has exposed dentin at the cervical third of the tooth, this added acid process could quickly cause dentinal hypersensitivity.

Drinking a low pH beverage can lead to sensitivity in two ways. First, the lower pH of the beverages can keep the patient’s mouth in a constant acidic state, increasing the risk for dentinal hypersensitivity. Second, beverages are usually consumed cold or with ice, which also can cause the patient to experience signs and symptoms of sensitivity.

Typically, dentin will have a smear layer or microcrystalline and organic debris that is found on the root after instrumentation, brushing or due to the formation of acquired pellicle. When the acid from beverages is constantly surrounding the tooth, this smear layer is removed, which opens the dentinal tubules, thus allowing fluid to flow in and out toward the pulp and resulting is discomfort and pain. This process is known as the Hydrodynamic Theory.

This theory suggests that stimuli move fluid in or out of the dentin, and that this fluid activates interdental or pulpal nerves to cause pain. When the tooth does not have a smear layer to cover the dentinal tubules, this fluid can move freely. The migration of gingival tissue due to gingivitis and or periodontal disease can also cause the root to be exposed to the fluids we drink daily.

True dentinal sensitivity is multifactorial. The constant acid environment is just one of these factors. In essence, there is not a true sensitivity caused by just soda. However, we can rule out the possibility of the patient’s diet having an over-abundant amount of acid-containing soda in his or her diet during our initial assessment phase.

How can we assess the patient for soda consumption and dentinal sensitivity?

As with all assessment strategies in dentistry, we must first ask each patient the important questions regarding the consumption of soda and other acidic beverages. It is important that they understand what this means and which beverages might be acidic. By providing patients with a visual chart of common popular drinks, we can help them understand how these drinks can be the cause of sensitivity. A laminated beverage chart is a clearly understood and convenient source of information about these beverages.

Many patients are not aware of the connection between these popular beverages and how the pH
is an important factor with regard to dentinal hypersensitivity. A thorough questionnaire or dietary analysis will flush out the potential for sensitivity caused by acid erosion and the overconsumption of acid-containing beverages.

Acid erosion can also be caused by medical conditions such as gastroesophageal reflux disease, also known as GERD. However, this condition would cause erosion on the lingual surfaces of the teeth due to the low pH of gastric juices regurgitated into the oral cavity and not the erosion that would be consistent with soda, which is equally distributed throughout the oral cavity.

A bulimic patient would also show erosion on the lingual surfaces of the teeth for the same reason as seen with GERD.

Another assessment strategy is the visual clinical exam. The patient should be evaluated for all types of sensitivity, including localized, generalized, periodontal, tooth decay, fractures, abscesses, coronal and dentinal sensitivity. By providing a typical clinical assessment, the dental clinician should be able to identify which type of sensitivity the patient might be suffering from.

What strategies can be implemented to reduce acid erosion and help to neutralize soda acid?

There are many strategies to help neutralize the acid in the patient’s mouth due to acid from the soda they drink. Once we have educated the patient on the acid content of soda and the destruction it can cause the enamel and dentin of all tooth surfaces, at-home strategies followed by chairside strategies can be implemented. This is the continuum of care for tooth sensitivity.

**What is the first line of treatment in the continuum of care for tooth sensitivity?**

First, instruct the patient to consume acidic drinks quickly and not to hold them in the mouth for an extended period of time. Using a drinking straw will keep the acid away from the tooth surface and lowers the time the acid beverage is on the tooth.

Instruct the patient to avoid brushing immediately after consuming acidic drinks, allowing a smear layer to accumulate on the tooth. Although it is logical to encourage tooth brushing immediately after consumption of sugared acidic beverages, research suggests that brushing enamel immediately after exposure to acidic beverages increases tooth loss.

Next, recommend brushing twice a day with a desensitizing toothpaste such as Sensodyne® as part of the at-home management of tooth sensitivity. The active ingredient, potassium nitrate, desensitizes the nerve endings responsible for the sensitivity. This creates a barrier around the tooth protecting the patient from generalized sensitivity. Sensodyne purchased over the counter (OTC) could be a suggested first line of care delivered at home twice a day.

**What is the second line of treatment in the continuum of care for tooth sensitivity?**

When the first line of treatment is not enough to relieve dentinal hypersensitivity, a dental office
application of NUPRO® Sensodyne prophylaxis paste, applied during a professional prophylaxis, is a chairside strategy that can be utilized for immediate relief.

This prophylaxis active ingredient is NovaMin®, which reacts with saliva to raise the pH. With elevated pH, calcium and phosphate precipitates as calcium phosphate and crystallizes to build a new hydroxyapatite-like layer over exposed dentinal tubules. The patient gets a stronger, more acid-resistant protective layer to protect his or her teeth.11

After completion of the professional prophylaxis, the patient can be given Sensodyne NUPRO Professional toothpaste. This paste delivers a combination of 5 percent NovaMin and 5,000 ppm of fluoride for daily use. This toothpaste combines fluoride for enamel and dentin remineralization and NovaMin, a patented technology for sensitivity protection.12

As our patients’ soft-drink consumption continues to increase, dental professionals need to be prepared to assess, educate and apply therapies for dentinal sensitivity treatment. By implementing a continuum of care, which includes take-home strategies and chairside therapies, the patient and the dental professional can work together as a team to resolve dentinal sensitivity caused by the overconsumption of our patients’ favorite drinks._

References

About the Author

Doreen Johnson, RDH, Med., is a clinical educator for DENTSPLY Professional, covering the Midwest region of the United States. She came to DENTSPLY with 21 years of clinical expertise and 10 years of experience as a dental hygiene educator. She is a graduate of the University of Pittsburgh School of Dental Medicine, holding certification as a dental assistant and a registered dental hygienist. She received her bachelor’s degree from Edinboro University in education, and a master’s degree from National Louis University in adult education. She also serves as an active dental hygiene consulting examiner for the North East Regional Board of Dental Examiners. Johnson has developed educational programs and presented them to dental and dental hygiene students, professional associations, dental societies, and study clubs both nationally and internationally. Her goal is to provide dental professionals with current scientific research and information to assist them in implementing effective and efficient evidence-based treatment protocols in their clinical practices. You may contact her at doreen.johnson@dentsply.com.