The Keyes Technique: An interview with Thomas Rams, DDS,

clinical periodontist and Professor of Microbiology and Immunology, Temple University School of Dentistry

by Maryann Napoli

MN: Like a lot of people, I was very interested in the Keyes technique back in the early 1980s and wrote about it as an alternative to periodontal (gum) surgery. Its self-care, inexpensive simplicity had wide appeal because it relied on daily applications of baking soda and hydrogen peroxide to prevent tooth loss due to periodontal disease. The technique, which reduced the bacteria that grow as dental plaque on tooth surfaces, was developed by a dentist at the National Institutes of Health named Dr. Paul H. Keyes (rhymes with skies).

Periodontal surgery, at the time, was a relatively new treatment, and I remember the pushback from periodontists who warned against the use of hydrogen peroxide as too abrasive to apply to the gums. There were also objections from dentists about Keyes’ use of systemic antibiotics in certain circumstances. The American Academy of Periodontology eventually took a stand against the Keyes technique. I haven’t thought about this controversy in years…that is, until I learned that you have the Paul H. Keyes Chair at Temple University School of Dentistry in Philadelphia. How did that come about?

TR: A wealthy New York woman named Claire Friedlander had ongoing problems with her teeth. Multiple periodontal surgeries didn’t work out, and she kept losing teeth. Eventually she found her way to Dr. Keyes who helped her keep her remaining teeth. She was upset that other dentists were bad-mouthing him and donated money for the Paul H. Keyes professorship in periodontology in 2004.

MN: What is the scientific basis for the Keyes technique?

TR: In the late 1970s and early ’80s, there was a significant debate among periodontists largely initiated by the work of Dr. Keyes at the National Institutes of Health. It was about the surgical vs. non-surgical treatment of periodontal disease. Keyes was interested in treating severe disease with an anti-bacterial strategy.

MN: Was he the first to see periodontal disease as a result of bacterial growth on the teeth?

TR: No. It had been observed way back in the 1680s by someone named Antony van Leeuwenhoek in The Netherlands who invented a microscope. The first substance he looked at was dental plaque from his own teeth. And he saw various micro-organisms similar to what we see today. Van Leeuwenhoek wrote letters to a London scientific society about these micro-organisms, which became the first descriptions of bacteria in recorded history. He noticed that there were many more of these micro-organisms in the debris from the areas where his gums were bleeding. If he immersed the plaque in vinegar, they stopped moving. He couldn’t find the same micro-organisms in other substances like rain water. And when he rinsed his mouth out with vinegar solutions, the number of organisms would go down. He had already made a connection between inflammation and these micro-organisms. No one picked up on it.

MN: So, periodontally speaking, there was a long dry spell between the 17th century and Dr. Keyes.

TR: Dental plaque wasn’t given attention until the 1960s when Paul Keyes became the first to demonstrate that there are particular types of bacteria in dental plaque that were more pathogenic (infective). He was the first one to develop an animal model system to study periodontal disease. He was then at the University of Rochester and it was an important step forward. Instead of doing surgery, he did non-surgical scaling of the
teeth and applied different antiseptics topically to the tissues and flooding the periodontal pockets as a way of killing bacteria. And also in certain circumstances, he used systemic antibiotics—short term use, that is.

**MN:** What about the hydrogen peroxide that got periodontists so exercised back in the 1980s?

**TR:** Peroxide was only a secondary part of the Keyes method. It was primarily the baking soda. While he was at the NIH, a woman in her mid-nineties came in as part of an aging study. She had all her teeth and allowed Keyes to take plaque samples. When she was found to have none of the pathogens implicated in periodontal disease, she was asked what she’d been doing. “I come from the Appalachian Mountains of West Virginia. During the depression we couldn’t afford tooth paste, and my grandma told me to brush my teeth with baking soda,” she answered. “I’ve done that all my whole life.”

That started Dr. Keyes’s investigation of the anti-bacterial properties of baking soda. It turns out that the periodontal pathogens are highly sensitive to baking soda. Instead of using the dry powder, which is abrasive, you can make a paste with tap water. It then becomes non-abrasive but still retains its antibacterial properties. The addition of hydrogen peroxide just provided some foaming effect, but it’s not helpful in the mouth because it’s broken down by a number of enzymes in the saliva. In short, the baking soda was doing most of the (bacteria) killing, not the peroxide. Now people can buy baking soda toothpaste. [Note: Arm & Hammer, the baking soda company that also makes baking soda toothpaste, appears to be unaware of Dr. Keyes’ work. The company lists baking soda as an inactive ingredient of its toothpaste.] I recommend the baking soda toothpaste because you can buy a version with fluoride added for anti-decay activity.

**MN:** What is the Paul Keyes legacy?

**TR:** He was right on target. We never knew back in the 1960s what good oral hygiene was. There was a study mentioned in the British journal The Lancet in the early 1990s that had followed people who at age 35 did not have periodontal disease. Fifteen years later, two-thirds of those who didn’t brush their teeth very well had periodontitis, compared with one in ten of those who had had good oral hygiene at age 35.

**MN:** What’s good oral hygiene today?

**TR:** Using an electric, or powered toothbrush is much better than a manual toothbrush because it provides a tremendous disruption of the dental plaque from the tooth surfaces and around the teeth. Flossing is important and if you can’t floss they have what we call intra-dental brushes for patients with periodontal breakdown (inflamed gum tissue). Dental flossing is also important. I have my patients with severe periodontal breakdown use a Waterpik, or oral irrigator, to flush the area between and around the teeth with baking soda diluted water or a very highly diluted bleach. People who don’t floss very well can use an oral irrigator on a preventive basis. This device is also good for people with dental implants because it makes it easier to get around the restorations.

**MN:** How would a person know whether these self-care preventive practices are actually working?

**TR:** The sad thing is you won’t. Periodontal disease is a relatively silent condition. Patients can develop relatively advanced lesions where they don’t suffer pain and have little awareness their mouth is deteriorating. They may see bleeding from gum tissue when they brush and floss their teeth. But a patient can’t usually tell just how serious it is. Loose teeth are usually associated with a rather advanced disease. Much of the detection, however, relies on a dentist taking a periodontal probe and advancing it around the tooth to see if there’s a loss of periodontal attachment to the tooth and considerable bleeding.

**MN:** The current use of antibiotics in the treatment of advanced periodontal disease seems like one sign that mainstream dentistry has accepted Dr. Keyes’s research demonstrating that periodontal disease is a bacterial disease.

**TR:** Back in the early 1980s there were major objections—from periodontists in particular—about the so-
called Keyes technique because, for certain patients, systemic antibiotics would be prescribed. It is ironic that, now 25 years later, the periodontal community has reached a consensus both here and in Europe about the use systemic antibiotics. Based on systematic literature reviews, commissioned respectively by the American Academy of Periodontology and the European Federation of Periodontology, both organizations concluded that for certain patients with severe periodontal disease, short-term systemic antibiotics, in combination with non-surgical scaling, are extremely valuable. As of about six years ago, this is the recommended approach.

MN: And it’s only recommended for people with severe disease.

TR: There’s little benefit to giving a systemic antibiotic to someone with gingivitis. Very little benefit for moderate periodontitis.

MN: How is the antibiotic chosen?

TR: That depends on the bacterial profile [of the patient]. Probably most widely used is the combination of two antibiotics—one is metronidazole and the other is amoxicillin—for one week.

MN: What about the use of antibiotic gels that hygienists apply directly to the periodontal pockets?

TR: This has some benefit but not as profound as the systemic agents. It tends to get washed out.

MN: While preparing for this interview, I read that your dental school at Temple University has one of only three laboratories in the U.S. that cultures dental plaque. Is this routinely done for tough cases?

TR: The top of the line approach is to do microbiological testing as a means of selecting the best antibiotic regimen for a particular patient. This is endorsed by the American Academy of Periodontology. Otherwise dentists might select an inappropriate antibiotic where the target organisms are resistant. We have evidence that resistance to periodontal micro-organisms is increasing. Only a few dentists use microbiological testing unfortunately. And that’s too bad because they are making an informed guess.

MN: How would anyone know about where to send a plaque culture? Would the average dentist know about these labs?

TR: They can go to the Internet. Our dental school has a website that describes our lab. So do the University of Southern California and University of North Carolina [dental schools].

MN: Is there a role for periodontal surgery today?

TR: Yes, for esthetic reasons.

MN: Gum surgery for cosmetic reasons!

TR: Yes, for people with severe gingival recession of the front teeth that gives them an elongated look. And there are patients for whom non-surgical methods are not working sufficiently. Then by all means, go ahead have surgery, which has evolved differently since 30 years ago. One of the reasons why there’s a diminished debate about surgery vs. non-surgery for periodontal disease is so many of natural teeth are being extracted and replaced with implants today. Yet this doesn’t exactly solve the situation in that the person still has to maintain good oral hygiene. If you have periodontitis and you go through treatment, it’s important to get rid of the bacterial pathogens and if you don’t get rid of them, you will have recurrent breakdown. If you have dental implants, and your natural remaining teeth have periodontal pathogens on them, then these pathogens can spread from the natural teeth and can lead to a periodontal diseaselike
breakdown that eventually causes loss of the dental implants. I can’t stress enough the importance of good oral hygiene.

**MN:** After the person with natural teeth and/or implants successfully gets rid of the pathogens, then what?

**TR:** Then benign bacteria begin to grow in your mouth. You don’t have a sterile mouth post-treatment. Some patients make the transition from pathogenic to benign; but for others, it’s a more difficult transition because periodontal disease persists or keeps coming back. In any case, this recolonization process had to take place on its own. Now for what’s new: We have known for about 25 years that there are certain benign bacteria that actually inhibit the periodontal pathogens. There are three particular streptococcal bacteria that don’t cause periodontal disease or tooth decay. If you grow them in culture with periodontal pathogens, they inhibit the growth of the periodontal pathogens. They are natural bacteria that grow in the dental plaque of people with healthy teeth and gums, and they secrete hydrogen peroxide. We always wanted to be able to promote those organisms to overgrow so they would block out the pathogens.

**MN:** And now you can?

**TR:** Yes, there’s a researcher who used to be at Harvard Dental School and then at University of Florida. Jeffrey Hillman, a periodontist with a PhD in microbiology, did some of the pioneering work on what is called bacterial antagonisms in the periodontal microflora. He discovered that if you take Streptococcal uberis and Streptococcal oralis that produce the most peroxide of any of the streptococci—they inhibit almost all of the periodontal pathogens. Dr. Hillman, now a retired professor emeritus, has come up with a lozenge that dissolves in your mouth and what comes out of the lozenge are millions of S. oralis and S. uberis that are alive. And there’s a third bacterium I’ll get to in a minute.

**MN:** So the lozenge contains probiotics.

**TR:** Yes, Evoralplus can be purchased over the Internet without a prescription. These lozenges can change the balance of the microbiology in the mouth towards one that is more conducive to maintaining periodontal stability.

**MN:** Is this product only for people who have had these pathogens cleared up? Can a person go wrong taking these lozenges without having his or her pathogens cleared up professionally?

**TR:** We don’t know that. If they have periodontal disease, this is not the only answer. They need to have their teeth scaled, good home care, etc. But if you can get these benign organisms to grow in your mouth before you get periodontal disease, you may never get it.

**MN:** You’re suggesting this product could be preventive. Has this been proven?

**TR:** No, it hasn’t been studied well, but all the elements are there. There is no evidence that these bacteria can cause dental disease. In animal studies, they’ve shown that once these micro-organisms are introduced, the periodontal pathogens are prevented from getting back in.

**TR:** The third organism in this product is S. rattus, a very interesting bacterium. It’s similar to the bacterium that causes tooth decay, which is Streptococcus mutans. S. mutans will overgrow in a mouth when people eat a lot of sugar. It produces lactic acid that will start to degrade the tooth surfaces and cause tooth decay. By culturing out millions and millions of bacteria, Dr. Hillman found this unusual bacterium called S. rattus, which is similar to the one that causes tooth decay. But here’s the big difference: S. rattus gobbles up sugar without producing lactic acid. So if you can get S. rattus overgrowing in your mouth, you can block the introduction of the tooth-destroying S. mutans. Bacteria compete against each other, and sometimes one side gets the upper hand.