

# The Right-Fit Treatment for Caries Infections

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## Introduction

Rising costs, aging populations, and the emergence of new technologies are just a few of the challenges facing dentistry. To address these challenges, the dental profession has endorsed an evidence-based approach to clinical practice and oral health care. The goal of evidence-based dentistry (EBD) assists practitioners to provide individualized right-fit treatment options by integrating the best available evidence with our clinical expertise and the preferences of the patient.

## Current Cariology

To grasp the opportunity new products provide, we need to consider our traditional disease-based thinking. There are many caries infection myths believed by both patients and professionals. (Figure 1)

We use the terms caries and cavity interchangeably. This is no longer accurate. Current cariology theory has moved from a hole to be fixed to risk that can be eliminated, reduced and managed.

In other words, caries is an infection; a cavity is the outcome. Repairing the cavity with a restoration does not eliminate the infection or risk for infection.

What's more, caries is a pH mediated infection, NOT caused by sugar. It's time to shift dentistry's focus from finding the results of the infection (a cavity) to treating the caries pH infection disease. Watching and waiting for breakdown makes no sense.

For many reading this article, our education taught us the *Specific Plaque Hypothesis*. Though there are many species in the oral flora, the theory stated that only a few specific species caused damage.<sup>1</sup> That theory has been replaced with *Extended Ecological Plaque Hypothesis*. Rather than specific species, the biofilm shifts from a balance supporting health to an acidic environment that allows certain species to thrive.<sup>2</sup>

We all learned the pH scale goes from 1 to 14. A pH of 1 being the most acidic with a pH of 7 neutral. Studies have shown acidic pH levels are associated with a greater risk

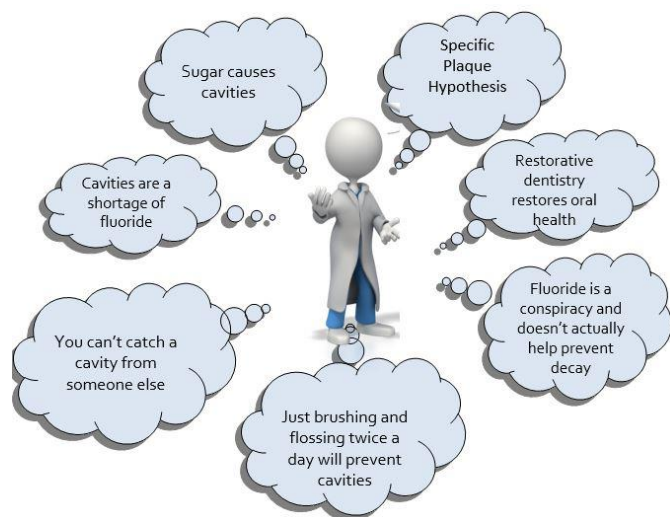


Figure 1 Caries Infection Myths

of serious health conditions including type 2 diabetes, heart disease, and obesity.<sup>3-5</sup> At a pH of 5.5 the teeth begin to demineralize putting them at risk for caries infection.

### **Demineralization-Remineralization Cycles**

Enamel and dentin go through unlimited cycles of oral demineralization and remineralization. Under normal physiological conditions, salivary pH ranges from 6.2-7.6 and is supersaturated with calcium and phosphate ions. When the pH falls to below 5.5, a shift occurs and the saturation point of the minerals changes.

The lower the pH, the higher the concentrations of calcium and phosphate required to reach saturation with respect to hydroxyapatite. This is called the *critical pH*. The critical pH of hydroxyapatite is around 5.5 and fluorapatite is around 4.5. Below critical pH, demineralization occurs while above critical pH, remineralization occurs. This cycle is dependent upon enamel solubility and ion gradients and varies with individual patients.<sup>6</sup>

### **Measuring pH**

The diagnosis of active phases and patients at risk for active disease is a challenge for clinicians. Neither dental professionals nor the patients can magically know their pH without testing. Compelling reasons exist to use saliva as a diagnostic fluid. It's easy to access inexpensive, non-invasive and easy-to-use.

There are many disclosing products available on the market. A unique chairside tool for the assessment and motivation has come to market. Disclosing is not anything new but this innovative disclosing gel that identifies new (red-pink), mature (dark blue/purple) and *acid producing biofilms* (light blue). This products helps dental professionals and patients to easily visualize what is happening in their mouth.

We know many things affect ph. After you demonstrated pH to the patient at the office, we want to continue the person's awareness. Most all our patient have smart phones. A new innovation [pH2OH](#) is a mobile phone application. Developed by A.T. Still University Dental School, Mesa, AZ, the FREE app works with both iOS and Android and requires no login. (Figure 2)

Knowing the pH has provided compelling, tangible, concrete reasons to do something. Should it be the traditional brush, floss, rinse lecture? How well does that work for the patients to truly affect the pH?



Figure 2 pH App

### **Product Ingredients**

By now, most oral health professionals have heard of the ingredients Amorphous Calcium Phosphate (ACP), Tri-Calcium Phosphate (TCP) and RECALDENT™ (CPP-ACP). Each of these ingredients functions a bit differently in the oral environment.

Amorphous calcium phosphate (ACP) is an inorganic amorphous calcium phosphate technology. ACP is a reactive and soluble compound. ACP rapidly releases calcium and phosphate ions to convert to apatite and remineralize tooth structure. ACP is available in a variety of products, including dentifrices, prophylactic pastes, fluoride varnish, fluoride gels, pit and fissure sealant materials, desensitizing agents, cements, and tooth whitening agents.

Tri-calcium phosphate (TCP) is a hybrid material created with a milling technique that fuses beta tri-calcium phosphate and sodium lauryl sulfate or fumaric acid. The product manufacturer says functionalized TCP, is a “smart” calcium phosphate system, Products available with TCP include a 5,000 ppm sodium fluoride dentifrice and a 5% sodium fluoride varnish.

RECALDENT™ is the trademark of a protein known as CPP-ACP (casein phosphopeptide-amorphous calcium phosphate.) The mechanism of action works this way: Fluoride ions promote the formation of fluoroapatite in the presence of calcium and phosphate ions. Yet, fluoride ions can only promote remineralization of enamel with fluoroapatite if enough salivary calcium and phosphate ions are available when the fluoride is applied. This means the topical application of fluoride ions are the limiting factor for net enamel remineralization to occur.<sup>7-8</sup> (Figure 3)

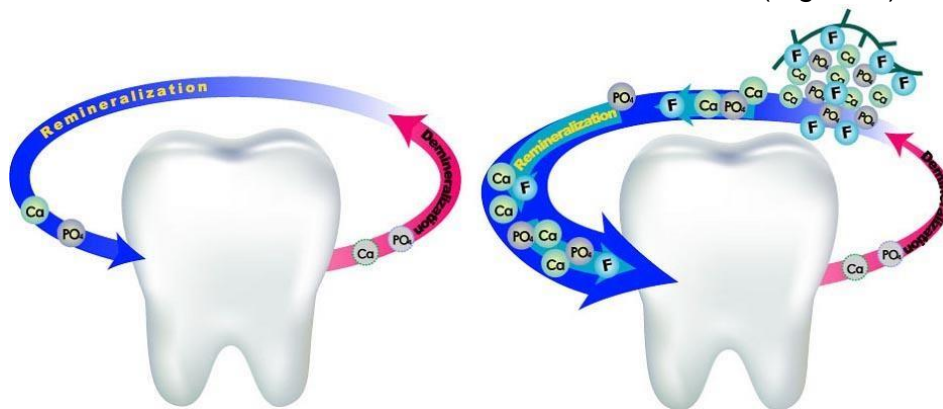


Figure 3 Bioavailable Ions

The important role of casein phosphopeptide (CPP) is as an amorphous calcium phosphate (ACP) carrier localizing the highly soluble calcium phosphate at the tooth surface. This localization maintains high concentration to calcium and phosphate ions in the subsurface enamel and surrounding biofilm, thereby facilitating remineralization. CPP-ACP plus fluoride has been shown to increase fluoride's uptake into subsurface enamel and increase subsurface enamel remineralization due to the bioavailable ions.<sup>7-8</sup>

### RECALDENT™ (CPP-ACP) Product Expansion

The RECALDENT™ ingredient is found in in-office fluoride and glass ionomer cements products, chewing gum, topical treatments for home use. Now in 2017, RECALDENT™ is in a single-step home treatment and cleaning product.

This single-step product, MI Paste® ONE by GC America, has all the features enabled by RECALDENT™ plus that of a toothpaste including:

- Calcium, phosphate and fluoride remineralization
- Binds to the tooth surfaces to localize bio-available minerals
- CPP-ACP occludes the dentinal tubules

This single-step treatment and cleaning product has mild abrasives with a low RDA (Relative Dentin Abrasivity) value of 64. (Figure 4)

Product Name	RDA
Toothbrush with water	4
Plain baking soda	7
Arm & Hammer Dental Care	35
Clinpro5000	63
<b>MI Paste ONE</b>	<b>64</b>
Colgate Total	70
Sensodyne Repair and protect	104
Crest Cavity protection	107



Figure 4 Relative Dentin Abrasivity

In addition to 10% RECALDENT™, this single-step treatment and cleaning product is anti-carries with its 1,100 ppm active sodium fluoride. It also desensitizes with 5% potassium nitrate.

## How to Use

For maximum benefit, just like with other toothpastes, it is recommended to not rinse immediately after brushing.<sup>9</sup>

1. Apply a small, pea-size amount to your toothbrush.



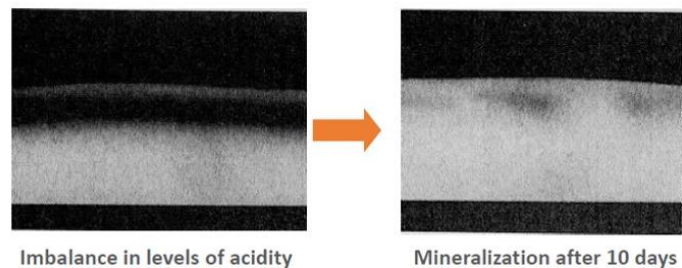
2. For best results, brush for 2 minutes, twice daily, and do not rinse.



This product is SLS-free (sodium lauryl sulphate). Instead it contains a milder surfactant. The mild foaming helps to reduce the discomfort after no-rinse brushing. It is designed to be gentle to teeth but with high cleaning efficacy.

## The Evidence is In

Current cariology and our understanding of pH busts the caries infection myths. This dictates the need for a variety of options to be offered. Brushing with this single-step treatment and cleaning product is simple, easy-to-use choice with huge benefits as this scanning electronic microscope photo shows. (Figure 5) It adds another arrow to our professional quiver to deliver individualized right-fit treatment options to our patients.



### Method & Results

- With the 1.0% CPP-calcium phosphate (pH 7.0) solution the mineral content determined by micro densitometry.
- Replacing 63.9 +/- 20.1% of mineral lost at an averaged rate of 3.9 +/- 0.8 x 10<sup>(-8)</sup> mol hydroxyapatite/m<sup>2</sup>/s.

(Reynolds, E. C., J. Dent. Res., 76, 1578-1595, 1997)

Figure 5 SEM Acid Challenge/Remineralization

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## References

1. Rosier BT, De Jager M, Zaura E, Krom BP. *Historical and contemporary hypotheses on the development of oral diseases: are we there yet?* *Frontiers in Cellular and Infection Microbiology*. 2014;4:92. doi:10.3389/fcimb.2014.00092. Available at; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4100321>. Accessed 7/20/17
2. Hurlbutt, M; Novy, B; Young, D. *Dental Caries: A pH-mediated disease. CDHA Journal December 2010*. Available at: <http://fluoride-class-action.com/wp-content/uploads/hurlbutt-dental-caries-a-ph-mediated-disease-cdha-journal-winter-2010-cdha-org.pdf> Accessed 7/20/17
3. Javaid MA, Ahmed AS, Durand R, Tran SD. Saliva as a diagnostic tool for oral and systemic diseases. *Journal of Oral Biology and Craniofacial Research*. 2016;6(1):66-75. doi:10.1016/j.jobcr.2015.08.006. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4756071/> Accessed 7/22/17
4. Rosengard, H.;Elston, D. *Oral Manifestations of Systemic Diseases*. July 27, 2016. Medscape. Available at: <http://emedicine.medscape.com/article/1081029-overview> Accessed 7/22/17.

5. Nagelberg ,R. *The tidal wave of saliva research*, Dental Economics March 30, 2016. Available at: <http://www.dentaleconomics.com/articles/print/volume-106/issue-3/science-tech/the-tidal-wave-of-saliva-research.html> Accessed 7/22/17
6. Dawes, C. *What Is the Critical pH and Why Does a Tooth Dissolve in Acid?* J Can Dent Assoc 2003; 69(11):722–4. Available at: <https://www.cda-adc.ca/jcda/vol-69/issue-11/722.pdf> Accessed 7/22/17
7. Kaira, DD, Kalra, RD, Kini, PC, Allama Prabhy CR, Nonfluoride remineralization: An evidence-based review of contemporary technologies. J. Dent Alli. Sci 2014; 2: 24-33. Available at: <http://www.jdas.in/printarticle.asp?issn=2277-4696;year=2014;volume=3;issue=1;spage=24;epage=33;aualast=Kalra> Accessed 7/22/17
8. Moezizadeh, M.; Moayedi,S. *Anticariogenic Effect of Amorphous Calcium Phosphate Stabilized by Casein Phosphopeptide: A Review Article*. Journal of Biological Sciences 4(1): 132-136, 2009. Available at: <http://docsdrive.com/pdfs/medwelljournals/rjbsci/2009/132-136.pdf> . Accessed 7/22/17.
9. Pitts N, Duckworth RM, et al. Post-brushing rinsing for the control of dental caries: exploration of the available evidence to establish what advice we should give our patients. Br Dent J. 2012 Apr;212(7):315–20. Available at: [file:///C:/Users/Patti/Downloads/Post-brushing\\_rinsing\\_for\\_the\\_control\\_of\\_dental\\_ca.pdf](file:///C:/Users/Patti/Downloads/Post-brushing_rinsing_for_the_control_of_dental_ca.pdf) Accessed 7/25/17