

What is RECALDENT® (CPP-ACP)*?

The only natural solution of its kind, RECALDENT® (CPP-ACP):

- Is a naturally occurring milk protein
- Protects the ACP component
- Is very sticky
- Acts as an effective delivery vehicle for ACP to the tooth

Only RECALDENT® (CPP-ACP):

- Uses naturally occurring molecules (CPP) that bind calcium and phosphate ions and stabilize ACP
- Delivers the essential building blocks of teeth in a non-crystalline state to your patients' teeth

RECALDENT® (CPP-ACP) technology has proven its effectiveness time and again as the most researched, evidenced-based calcium phosphate delivery:

- First developed and tested in Australia
- Extensively researched by the University of Melbourne Dental School beginning in the 1980's
- Dozens of clinical trials and laboratory studies worldwide

The power of RECALDENT® (CPP-ACP) and fluoride together.

When fluoride meets RECALDENT® (CPP-ACP), the peptide preferentially combines with, and stabilizes, fluoride to create an excellent source for building fluorapatite. Using bio-available calcium, phosphate, and fluoride, the full potential of fluoride to help protect and repair teeth can be achieved.

In other words, MI Paste Plus®, MI Paste® ONE, MI Paste® ONE Kids, and MI Paste® ONE Perio, all containing RECALDENT® (CPP-ACP) and fluoride, are excellent remineralization delivery vehicles for fluoride.

*CPP-ACP = Casein phosphopeptide Amorphous calcium phosphate.

a) Garry et al (2015). ORCA abstract. 133 Caries Res 49:297-309. b) Hicks, Flaitz (2013). J Dent Res 92 (Spec Iss A): 773. c) Katsura et al (2010). Niigata Dent J. 40(1):53-57. d) Durassamy et al. (2013). J Pharm Bioallied Sci. 7(Suppl 2):S513-517. e) Akın M, Basolici FA. (2012). Angle Orthod. 82:770-775. f) Cochrane et al. (2010). J Dent Res 89(11):1187-1197. g) Shen et al. (2011). J Dent 39:518-525. h) Robertson et al. (2011). Am J Orthod Dentofacial Orthop. 140(5):660-668. i) Srinivasan et al. (2010). Arch Oral Biol 55:541-544. j) Sakaguchi et al. (2006). J Dent Res 85(Spec Iss B):191. k) Bailey et al. (2009). J Dent Res 88:1148-1153. l) Cochrane et al (2009) ORCA abstract 42. Caries Res 43:179-244. m) Emamiieh et al (2015) Novelty in Biomedicine 3(1):33-37. n) Pukallus et al (2013) Pediatr Dent 35(7):550-555. o) Cochrane NJ, Reynolds EC (2012) Adv Dent Res 24(2):41-47. p) Sato et al. (2011). J Dent Res 90 (Spec Iss B): 4174. q) Heshmat et al. (2013). J Dent Res 92 (Spec Iss B): 8202. r) Connor et al. (2014). J Dent Res 93 (Spec Iss A): 270

Caution: RECALDENT® (CPP-ACP) is derived from milk casein. Do not use on patients with a milk protein or hydroxybenzoates allergy. In case of allergic reaction, stop use, rinse mouth with water, and seek medical advice.



Synergizes with Fluoride^{a-i}

CPP-ACP promotes the incorporation of fluoride into plaque and sub-surface enamel, producing effects superior to those that can be achieved by using fluoride alone.



MI Paste Plus® & MI Paste® ONE Inhibit Demineralization and Promote Subsurface Enamel Remineralization^{e-l}

Fluoride with CPP-ACP is a proven technology that promotes sub-surface enamel remineralization.



pH Buffer^{m-r}

(Helps neutralize pH levels in the mouth)

In a recent clinical study, application of MI Paste® elevated plaque pH levels for 48 hours, while application of MI Paste Plus® elevated plaque pH levels for 96 hours.

How the MI Paste® Family Works

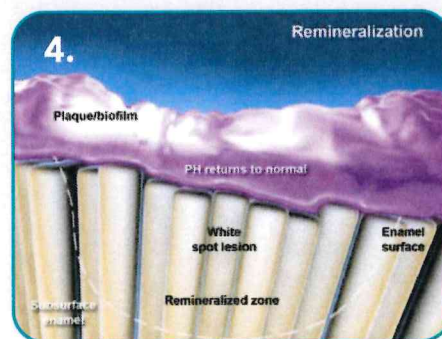
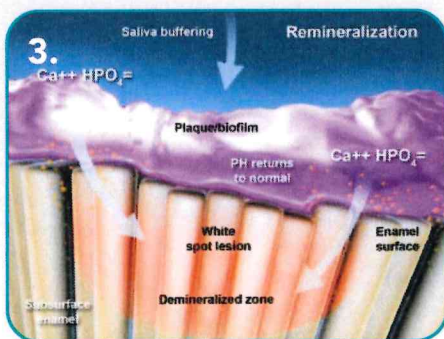
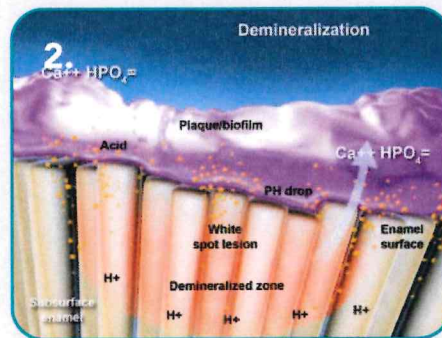
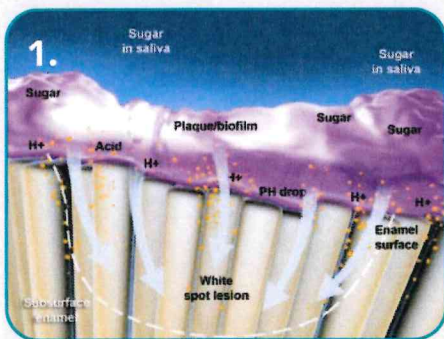
MI Paste® products release RECALDENT® (CPP-ACP) - a natural milk protein peptide that adheres to soft tissue, plaque, pellicle, and enamel's hydroxyapatite delivering amorphous calcium and phosphate (ACP) into the saliva. The mechanism of action is similar to that of the salivary protein statherin and the supply of bio-available calcium and phosphate is able to drive remineralization by Fluoride (MI Paste Plus®, MI Paste® ONE Kids, MI Paste® ONE Perio, and MI Paste® ONE), buffer acid, and reduce the plaque acid effect on tooth structure.

An analysis of the chemistry of demineralization and remineralization indicates that a major source of mineral loss in the caries process is the destruction of apatite with the creation of water as a by-product, and the leakage of a neutral species calcium hydrogen phosphate across a porous enamel surface.

When placed on the surface of a tooth, RECALDENT® (CPP-ACP) interacts with hydrogen ions and forms the same species calcium hydrogen phosphate which, under a diffusion gradient, can enter the tooth, react with and consume the water to produce enamel mineral, thereby removing subsurface mineral defects.

MI Paste Plus®, MI Paste® ONE Kids, MI Paste® ONE Perio, and MI Paste® ONE treatments of enamel subsurface caries have been shown to cause rapid remineralization, which causes a change in the appearance of the lesions.

Any incipient white spot lesions which are developing because of cariogenic plaque can be treated locally with RECALDENT® (CPP-ACP) to achieve subsurface remineralization by Fluoride (MI Paste Plus®, MI Paste® ONE Kids, MI Paste® ONE Perio and MI Paste® ONE). This may occur in fairly short periods of time – in the order of two to four weeks.



Figures and text courtesy of Dr. Steven Steinberg.

Figure 1: Bacteria in the plaque on the attacked tooth surface metabolize available sugar and produce acid. That acid (depicted in Figure 1 as hydrogen ions) penetrate the solid, yet microscopically permeable tooth surface.

Figure 2: The acid drives calcium and phosphate out of the subsurface tissue, thus, demineralizing it. The result is an initial white spot lesion.

Figure 3: Since the tooth surface is intact, the reverse biochemical process can occur. Saliva buffering can reverse the low pH in the plaque and with the raised pH, calcium and phosphate are delivered back into the tooth.

Figure 4: Remineralization of the tooth. The key is the integrity of the tooth surface; if it remains intact, uncavitated, remineralization is possible.

Characteristics of CPP-ACP and Fluoride

Ensuring Fluoride Efficacy

Saliva is the main source of free calcium that will ensure fluoride's effectiveness. The salivary protein Statherin can bind and stabilize calcium and phosphate to maintain a state of saturation with respect to the tooth mineral under normal oral conditions.

However, if saliva quantity or quality is compromised, or if acid producing biofilms exist on smooth surfaces, or if the tooth is constantly challenged by acid (e.g. erosion), then significantly more calcium and phosphate is required to enhance fluoride's effectiveness. RECALDENT® (CPP-ACP) is the ideal source of such additional calcium and phosphate. When fluoride ions come into contact with RECALDENT® (CPP-ACP), the peptide preferentially combines with and stabilizes fluoride, to create the ideal source of ions for building fluorapatite.



Amorphous state

The casein phosphopeptide will bind calcium, phosphate, and fluoride in an amorphous state, (i.e. not crystallized). This is essential to its function of delivering bio-available minerals.



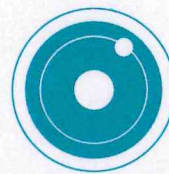
Adhesive

The casein phosphopeptide will bind to tooth surfaces to localize bio-available calcium, phosphate, and fluoride where it is most needed.



Ideal size

CPP-ACP and Fluoride (CPP-ACPF complex) is less than 2 nanometers in size and can penetrate biofilms and enamel. CPP-ACPF complex has a neutral charge, so is not hindered in its diffusion characteristics.



Release of ions

CPP-ACP and Fluoride (CPP-ACPF complex) is a significant source of calcium, phosphate, and fluoride ions, with an increasing level of release as the oral pH lowers.



pH buffer

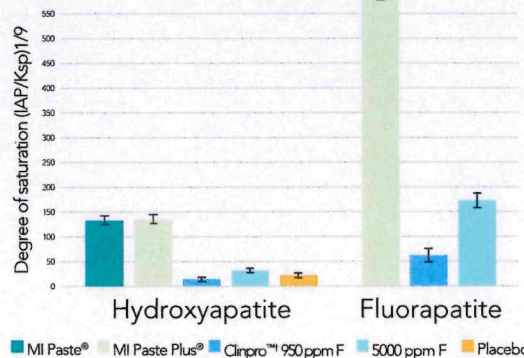
Via several mechanisms, CPP-ACP and Fluoride (CPP-ACPF complex) is an excellent buffer to counter acid challenges. Helps neutralize pH levels in the mouth.

Measuring Effectiveness - Changes In Salivary Mineral Content

A group of patients with normal salivary parameters applied various topical remineralization agents. After 3 minutes, the salivary contents were spit out and chemical analysis undertaken to determine the mineral forming potential of the saliva.

These results show the limiting factor for the effectiveness of a mineral formation is calcium and phosphate availability. MI Paste Plus® has a far higher potential to create fluorapatite based on its availability of calcium and phosphate, despite having a lower level of fluoride than many other fluoride containing products.

Degree Of Saturation Of Post-Rinse/Saliva with Respect To Hydroxyapatite And Fluorapatite



¹Clinpro™ is a trademark of 3M.

Effect of added calcium phosphate on enamel remineralization by fluoride in a randomized controlled in situ trial. Shena P, Mantona D, Cochrane N, Walker G, Yuan Y, Reynolds C, Reynolds E. Journal of Dentistry, Volume 39, Issue 7, July 2011, Pages 518-525

Changes in mineral content

Ensuring Fluoride Efficacy

Creating a highly controlled, proven method of measuring remineralization provides a mechanism for comparing different technologies and gives guidance for clinical recommendations. The use of an in situ model, where enamel slabs are demineralized, embedded in a palatal appliance and worn by volunteers who have healthy saliva, gives a good understanding of the effectiveness of different products. Results are imaged and measured using highly accurate microradiography as per the following research:

