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MEETINGS & EVENTS

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BONDING THROUGH CHEMISTRY

Better Tartar and Plaque Removal through Disruptive Technology

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Why are Tartar and Plaque Harmful?

Why are Tartar and Plaque Harmful ?

- Bacteria within tartar and plaque form strong organic acids.
- These acids erode tooth enamel and cause cavities.
- These acids also irritate gums.
  - Irritated gums pull away from teeth and form gum pockets.
  - Gum pockets fill with more tartar, plaque, and bacteria.
  - As gum pockets widen and deepen, lactic acid dissolves bone.
  - As bone loss progresses, teeth eventually fall away.
- Bleeding gums provide bacteria access to the bloodstream.

CDC estimates that half the US population over 30 have periodontal disease caused by tartar, plaque, and bacteria

https://www.cdc.gov/oralhealth/conditions/periodontal-disease.html

70% of US adults over 65 have periodontal disease (CDC data)

Numerous research studies have linked periodontal gum disease to a variety of other diseases including:

- Heart disease
- Glaucoma
- Diabetes

What is Tartar ?

Three-dimensional "resin like" solid matrix

Minerals Component – calcium and phosphate ions from saliva.

- $Ca_5(PO_4)_3OH$ - Hydroxyapatite crystals

Organic components - from bacteria and foods we eat.

- Bacteria – convert sugars to polysaccharides and plaque acids
- Polysaccharides
  - Plaque is sticky
  - Tartar is hard
- Polypeptide chains, glycoproteins

Dental Industry Approaches to Tartar and Plaque Removal

Reduce or stop hydroxyapatite crystal formation - $Ca_5(PO_4)_3OH$

- Stop calcium and phosphate ion crystalization
- Using chelating agents
  - EDTA
  - Calcium pyrophosphates, polyphosphate

Pyrophosphates & polyphosphates do not remove crystallized tartar

Chelating agents are short acting as saliva washes them away

Dental Industry Approaches to Tartar and Plaque Removal

- **Abrasives are used to remove sticky plaque before it hardens to form tartar.**
  - Abrasives cannot remove tartar without removing tooth enamel.
- **Antibacterials are used to kill bacteria and stop polysaccharide formation.**
  - Chlorine dioxide, hydrogen peroxide, triclosan, chlorohexidine gluconate.
    - Some antibacterials promote tartar formation.
- Abrasives that will remove tartar will also remove tooth enamel.
- Antibacterials are short acting and are washed away by saliva,
  - Some antibacterials (CHG) are known to promote tartar formation.

Typical tartar buildup after many failed 3 month trials

Brushing & Flossing 3X per day

TartarEnd LLC Approach to Tartar and Plaque Removal

Reduce or stop hydroxyapatite crystal formation - $Ca_5(PO_4)_3OH$

Abrade away sticky plaque before it hardens to form tartar.

Antibacterials to kill bacteria and stop polysaccharide formation.

Dissolve water insoluble polysaccharides.

- Some literature references to dissolving polysaccharides with DMSO and H_2SO_4.

Break polypeptide chains, glycoproteins.

- Limited academic or industrial literature references.

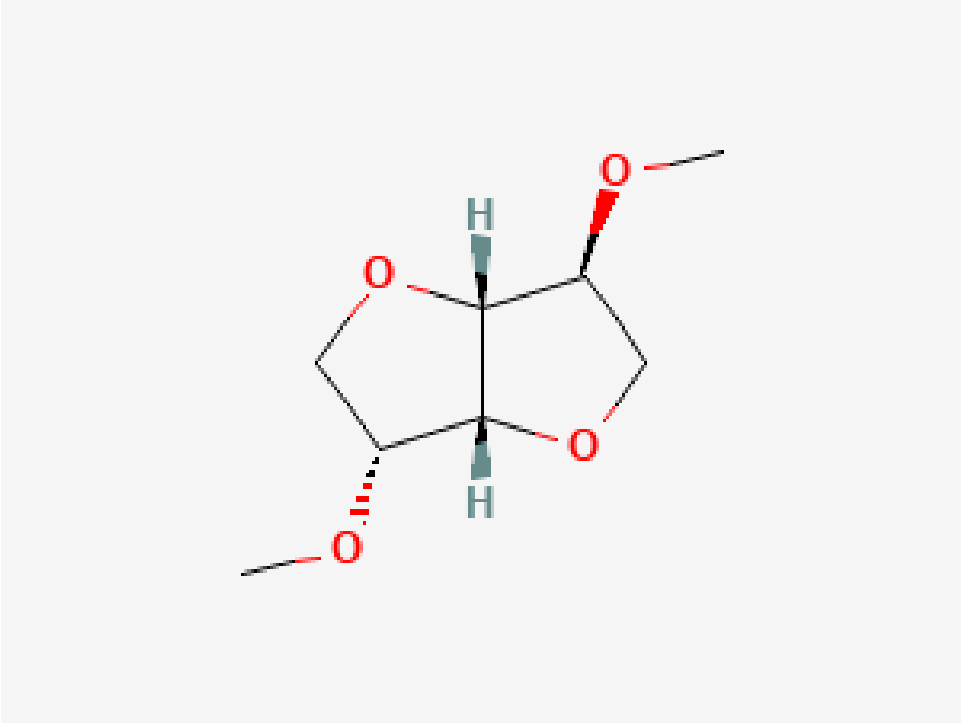
TartarEnd Strategy

Dissolve the tartar and plaque “glue matrix”

1. **Rehydrate water insoluble polysaccharides**
2. **Cleave polypeptide and glycoprotein chains**
3. ***Accomplish both in a 2-minute brushing cycle***

Dimethyl Isosorbide (DMI)
Rehydrate insoluble polysaccharides

- Developed in the mid 60s
- Commercially available
- Used in many cosmetic applications
- Softens tartar (24 hrs) in a beaker
    - 24 hrs. at 50% and 100% DMI



chemspider.com

Cleave polypeptide and glycoprotein chains
Sodium Chlorite >>>> Chlorine Dioxide

- Weakens biofilms in potable water systems, cooling towers
  - Selectively cleaves disulfide, amine, and peptide linkages
  - Relatively unreactive with polysaccharides
- Plaque is a biofilm
  - **ClO_2 passes through biofilm as a gas**
  - **ClO_2 selectively cleaves disulfide and peptide linkages**
- ClO_2 is safely used in a few toothpastes and mouthwashes
- Chlorine dioxide is readily available from sodium chlorite
  - $NaClO_2$ + Lactic Acid → $HClO_2$ → ClO_2

TartarEnd Mouthwash Trial

Remove Tartar and Plaque with brushing

- Mixed 1) Chlorine Dioxide, 2) Dimethyl Isosorbide, and 3) Water.
- Used syringe barrel to inject 3 ml into the mouth. No abrasives!
- Brushed for 2 minutes with a Phillips Sonicare Toothbrush.
- Brushed and flossed (string) twice daily.
- Dentist and hygienist comments after this 3-month study.
  - “You have no tartar at all”
  - “Your gums are healthy and clean”

3 Months Brushing with TartarEnd Mouthwash

– NO ABRASIVES !

Floss and brushing 2 minutes, 2x per day for 3 months
Before and After Photos – Which is the “before“ picture ?

TartarEnd Mouthwash used 3 Months with Brushing
– NO ABRASIVES !

Before TartarEnd

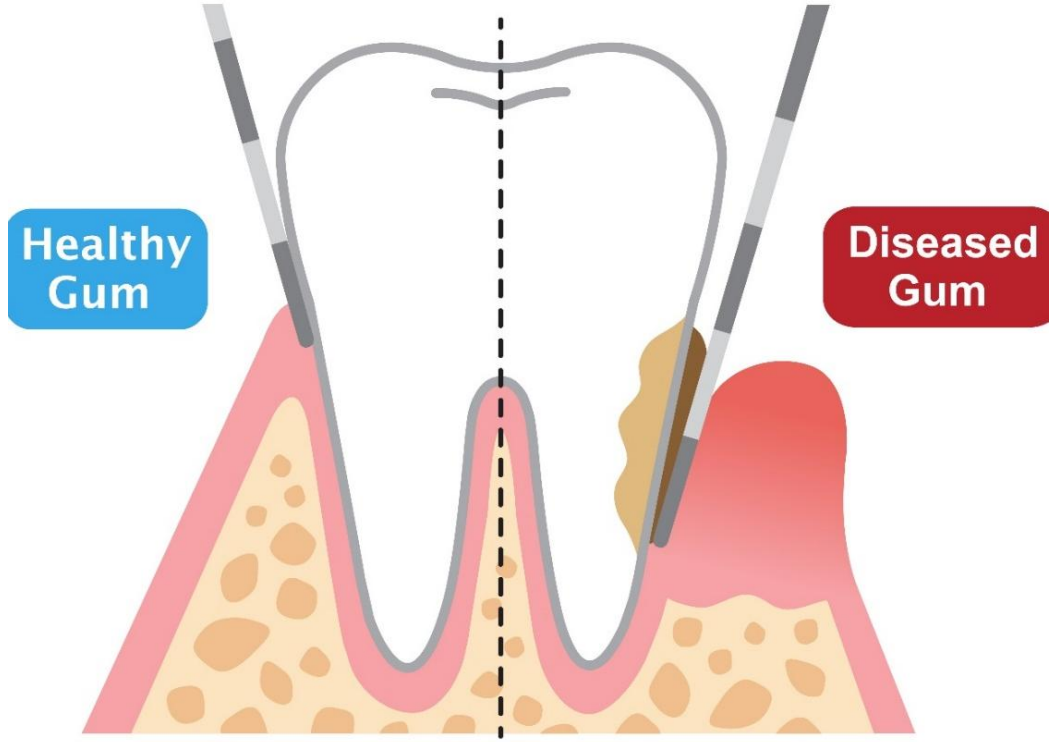
After TartarEnd

Chlorine dioxide, DMI, and water dissolve and soften tartar in 2 minutes

- DMI hydrogen bonding penetrates and disrupts the polysaccharides in tartar and plaque to promote water rehydration.
- At the same time chlorine dioxide (a gas) rapidly cleaves amines, disulfides in peptide chains. 95% consumed in 30 seconds.
- Water/DMI continue to rehydrate the polysaccharide glue matrix to form a hydroxyapatite paste.
- Brushing (sonic) removes the softened and dissolved tartar and plaque.
- Tartar fragments float away as a colloidal suspension.
- Tartar and plaque are removed **above and below** the gum-line.

TartarEnd formulation removes tartar and plaque

at least 5 mm below the gum-line and reverses periodontal pocketing

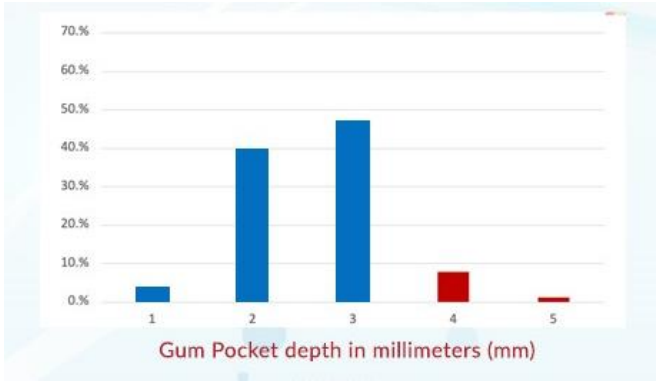


Gum Pocket Depth Reduction Examples

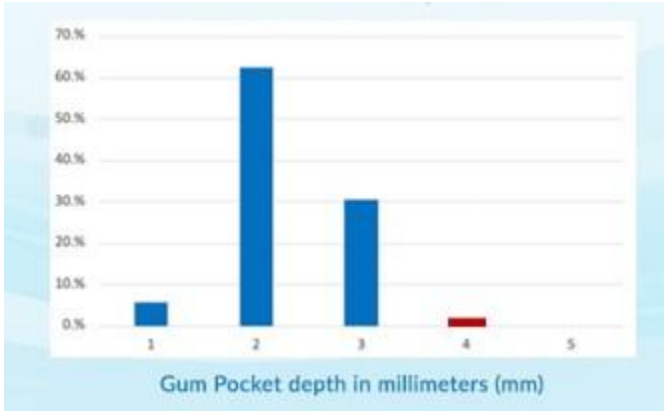
Using the TartarEnd formulation with sonic brushing eliminates periodontal gum pocketing as healthy gums reattach to tartar and plaque free teeth.

Average before and after periodontal gum pocket measurements for 3 adults over age 60 taken by oral hygienists. These adults used TartarEnd Toothpaste twice a day with a sonic toothbrush and flossed after brushing for 3 to 6 months.

Before TartarEnd



After TartarEnd



QUESTIONS?

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