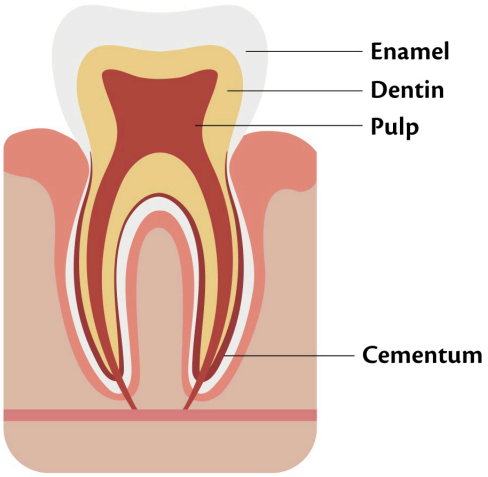
GUMS & TEETH, HEALTH, TRENDING

Hydroxyapatite vs. Fluoride: How Two Superhero Toothpaste Ingredients Compare

Fluoride is a proven cavity-fighter, but there's also a headline-grabbing, nontoxic, superstar ingredient on the market that has been shown to be as effective as fluoride with some added benefits: hydroxyapatite. (It's also the key ingredient Cocofloss co-founder and dentist Dr. Chrystle Cu chose for our Cocoshine Whitening Toothpaste.)

So what's the real difference between these two smile-strengthening superheroes? And how do you choose the best ingredient to boost your paste?

Elemental Enamel: What Are Teeth Made Of?



To really understand how any ingredient can help protect and even restore your teeth, we need to drill into what teeth are made of. There are four main toothy tissues:

1. At the center of each of your pearly whites is the **pulp**, a sensitive mass of nerves, blood vessels, and connective tissue.
2. Moving outward is hard-but-porous **dentin**, which has a yellowish color.
3. Then there's the **cementum**, which covers only the tooth root and helps keep your chompers anchored.
4. Finally comes the tissue that you see in the mirror every day: **enamel**, which is translucent.

The hardest substance in your body, harder even than steel, your teeth's enamel is almost entirely composed of hydroxyapatite — yep, the same thing as the superstar toothpaste ingredient.

Hydroxyapatite is made of the elements calcium and phosphate, arranged in a crystalized structure. Packed tightly together, these hydroxyapatite crystals provide powerful protection to the rest of your teeth's tissues and also allow you to bite into apples and other top treats for your teeth.

As you know, even your super-tough enamel is not impervious to cavities. To help your enamel battle the ongoing acid attack caused by the billions of bacteria in your mouth, you need to floss, brush, and use a toothpaste that helps restore and protect your enamel.

Nature's Patch for Pearly Whites: How Hydroxyapatite Remineralizes Enamel

As you just read, your super-hard enamel is 97% hydroxyapatite, a crystallized combo of calcium and phosphate. Your dentin, the layer just below your enamel, is 70% hydroxyapatite.

Oral-care products that contain hydroxyapatite usually use synthetically made nanoparticles of the mineral, or nano-hydroxyapatite (n-HA). Since they are microscopic, the hydroxyapatite crystals are able to deeply fill mini potholes in your enamel, literally remineralizing your teeth.

This dental discovery was first made in 1970 by NASA when they were looking for a way to keep astronauts' teeth and bones strong after bouncing around in zero-gravity environments. Later, a Japanese company called Sangi Co, Ltd., bought the rights to use n-HA in toothpaste — and it became a top choice for strong, shiny teeth in Japan. Slews of scientific studies later, n-HA can be found in toothpastes and dental-care products around the world.

Why are dental pros so excited about these tiny particles? Here's what n-HA can do for the health of your teeth:

✨ **Reverse early cavities:** By remineralizing tooth structure, n-HA may turn back the clock on the smallest cavities, before they become painful, gaping ones. This could save you a future bill for the dentist's drill.

✨ **Strengthen enamel:** N-HA deeply penetrates below the surface of your enamel to make your teeth stronger from the inside out. That leaves fewer places for cavity-causing bacteria to sneak in and cause havoc. Preliminary research also shows that n-HA may bind to bad bacteria, buffering your teeth from plaque attacks.

✨ **Repair sensitivity:** You know that painful feeling when you try to bite into a scrumptious ice-cream cone? That's a sign of dental sensitivity. But n-HA replaces lost minerals and fills dentinal tubules (tiny tunnels that lead to the tooth's nerves), helping to restore your teeth while blocking painful stimuli.

✨ **Whiten and brighten smiles**: N-HA makes smiles appear whiter and more sparkling by filling into the spots that accumulate stains. A smoother surface is a shinier surface.

Bond, Fluoride Bond: How Fluoride Repairs Your Teeth

Smile superhero #2 has been around the block. Fluoride is a naturally occurring mineral that's been studied since the early 1900s. It's regularly been added to toothpaste since the 1960s in an effort to reduce tooth decay. The majority of public water systems in the U.S. also fluoridate their water — a practice that started in 1945 — to help prevent cavities, even for those without access to regular dental care.

Whether your fluoride comes from your drinking water, food, or oral-care products, it regularly comes in contact with your enamel and becomes integrated with your saliva every time you ingest it. Without you feeling a thing, fluoride is then chemically attracted to the ions of two other minerals naturally swirling around your mouth: calcium and phosphate, the main building blocks of your enamel (see above).

Together, fluoride, calcium, and phosphate work their chemical magic, bonding to create another crystal lattice–structured compound called fluorapatite. When fluorapatite covers and integrates with the top layer of your enamel, it helps restore areas that have been damaged by acid and creates a kind of protective shield against further attacks.

Protective Shield or Penetrating Strength: Stacking up the Benefits of Fluoride vs. Hydroxyapatite

	 Fluoride Toothpaste	 n-HA Toothpaste
Fights Cavities	✓	✓
Remineralizes Teeth	✓	✓
Repairs Sensitivity	✗	✓
Whitens Teeth	✗	✓
Safe to Swallow	✗	✓

There is no doubt that fluoride works to fight cavities, just as multiple gold-standard studies have shown than hydroxyapatite works just as well or better than fluoride as an anti-caries agent.

So what sets hydroxyapatite apart in the benefits department?

HYDROXYAPATITE REMINERALIZES ENAMEL MORE DEEPLY

While fluoride does create a kind of thin shield around your enamel, it doesn't penetrate your teeth as deeply as hydroxyapatite. A study funded by the National Science and Engineering Research Council of Canada found that "in comparison to fluorides which are limited to only surface remineralization, HAP [hydroxyapatite] particles are able to penetrate into the deeper layers of the lesion."

This means that when you use a toothpaste with n-HA, you're not just coating your smile, you're bolstering its strength from within.

HYDROXYAPATITE HELPS REPAIR SENSITIVITY

It's true that a professionally applied fluoride varnish can also help with dental sensitivity, but fluoride in the form of toothpaste usually doesn't have the same effect. For most fluoride toothpastes to help with touchy-feely teeth, they must contain potassium nitrate or strontium chloride, numbing agents that temporarily help with the symptoms of sensitivity, but don't fix its underlying cause.

Hydroxyapatite, however, actually plugs the tiny tunnels in your enamel that lead to your tooth's ultra-sensitive, nerve-packed pulp. So your now-stronger teeth can block the stimuli that are causing you pain, whether it's too much heat, cold, or texture, with sustained positive results.

HYDROXYAPATITE WHITENS SMILES

If you're looking to restore your smile to its whitest, most lustrous self, hydroxyapatite takes the (sugar-free) cake. Fluoride toothpaste strengthens enamel with its shield-like coating, leading to a healthier grin, but it doesn't whiten teeth.

Here's how n-HA works to brighten pearly whites: N-HA deeply repairs microcracks and defects in your teeth, filling them with opaque, white hydroxyapatite crystals, so your enamel is smoother, more lustrous, and more reflective to light. The result: a whiter, shinier, more radiant smile from the inside out.

Safe to Swallow? Fluoride vs. Hydroxyapatite

Check out every box of fluoride toothpaste. You'll find a federally mandated warning about swallowing too much paste as well as a directive to call Poison Control. That's because when someone consumes too much fluoride, "it can cause irritation leading to nausea, vomiting, and diarrhea," according to the National Capital Poison Center (Poison Control).

The risk of swallowing excessive fluoride is also why some little kids' toothpastes are fluoride-free. When too much fluoride is consumed while teeth are developing, it can result in fluorosis — white spots and lacy markings, and in severe cases, dark brown stains on teeth. Since tots often can't be trusted to spit out their toothpaste, adults are advised by the CDC to not use fluoride paste on their kiddos until age 2, and then use just a rice-sized smear of fluoride on their kiddo's brush until age 3, or a pea-sized dollop until age 6.

According to the National Institutes of Health, a study reviewing data from 2011/2012 showed that 61.3% of American adolescents had at least mild fluorosis. The authors of the study concluded, "The continued increase in fluorosis rates in the U.S. indicates that additional measures need to be implemented to reduce its prevalence."

Some people may also be concerned that the combined consumption of fluoride from toothpaste, fluoridated water, and natural sources may lead us to take in toxic levels of this mineral without realizing it. This has led voters in some cities, including Portland, Oregon, to refuse to fluoridate their water. In fact, even the federal government called for lower levels of fluoride in drinking water beginning in 2015.

If you're ready to find a science-backed, nontoxic fluoride alternative, we've done the research for you: Hydroxyapatite is 100% safe to swallow. Since it's made from the very same minerals that make up your teeth, even a whole tube of the stuff won't make you sick (but um, yuck). That makes toothpaste boosted with hydroxyapatite a perfect choice for newbie brushers of any age.

> ***Toothy tip:*** *Smearing an extra bit of hydroxyapatite toothpaste on your teeth after you're done brushing can actually enhance its remineralization results. You can sleep with it on your teeth, giving it more time to bond with and strengthen your enamel.*

100% Clean Routine: Floss, Brush, Bliss

No matter which toothpaste you choose, your smile will only benefit if you stick to a regular flossing and brushing routine. That means properly flossing at least once daily, ideally before bed, with a high-quality, plaque-grabbing floss (you know the one). And also brushing at least twice daily for 2 minutes with a super-effective brush and cavity-fighting toothpaste.

Taking care of your smile shouldn't feel like a tiresome task, but an actual relaxing moment of meaningful self-care. Afterall, your mouth is the window onto your entire body's well-being — and a sparkling clean window always brings in more sunshine.

✨ ✨ ✨

Restore your smile's radiance with Cocoshine Whitening Toothpaste! A 4-in-1 powerhouse for pearly whites, Cocoshine is packed with n-HA and other nontoxic ingredients that safely whiten your smile, rebuild enamel strength, repair sensitivity, and balance your oral microbiome. Brush, rinse, SHINE!