

Study of Long-term Effect of Fluoride Toothpaste on Human Teeth

By [Ray Zhou](#)

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Abstract

To study the long-term effects of Fluoride toothpaste on human teeth, a two-month experiment has been carried out to simulate 47 years of exposure on a human tooth to Fluoride toothpaste under normal daily usage. Micro-cracks have shown up on both Enamel and Cementum surfaces, which is a sign of tooth degradation. While the Cementum surface has a much higher density of micro-crack networks. Cementum tends to get harmed by Fluoride more often than Enamel. This study does not include other factors such as chewing and the type of food residue stuck between teeth, which could potentially affect the tooth's health even further.

Introduction

Our teeth are a crucial part of our body. We need them to be able to masticate our food into smaller pieces for easier digestion. When we masticate, sometimes small pieces of food can get stuck on our teeth. In order to clean our teeth, we will commonly brush our teeth around 2-3 times a day with toothpaste. Most commercial toothpastes (such as Crest® or Colgate®) we see in our supermarkets contain an ingredient known as Fluoride, with a typical percentage of 0.25%, while some brands contain up to 0.75% Fluoride. Prescription Dental toothpastes can contain 5 times more Fluoride than commercially available.

Although most Americans have positive associations with fluoride and envision tooth protection along with strong bones, fluoride is actually the by-product of industry and its toxicity was recognized at the beginning of the Industrial Revolution during the 1850's, when iron and copper factories discharged it into the air and poisoned plants, animals, and people. The fluoride added to drinking water and toothpaste is a crude industrial waste

product of the aluminum and fertilizer industries, and a substance toxic enough to be used as rat poison. [1]

Fluoride has been used in the US to treat drinking water and added to toothpaste, all of which started from a carefully planned marketing program that began before the Grand Rapids, Michigan, which became the first community to officially fluoridate its drinking water in 1945 [2]. The big hope for fluoride was its ability to immunize children's developing teeth against cavities. Rates of dental caries were supposed to plummet in areas where water was treated, yet decades of experience and worldwide research have contradicted this expectation numerous times. Let alone overdosed fluoridation has been linked to Skeletal Fluorosis [3], Dental Fluorosis [4], Bone Fractures [5] [6], Fluoride Poisoning [7], Cancer [8] [9].

Since we are extremely concerned about the usage of Fluoride in the toothpaste commonly seen, an experiment has been planned to study the effect of Fluoride on human teeth under long term condition.

Materials & Methods

To figure out if fluoride contained in fluoride toothpaste is harmful to our teeth or not, an experiment of human tooth's long-time exposure to fluoride toothpaste has been designed and carried out to monitor the change of tooth surface.

To simulate years' usage of fluoride toothpaste on a human tooth, a real human tooth has been coated with prescription toothpaste for 2 months, which is equivalent to 47 years of exposure if 5 minutes of brushing with toothpaste per day is assumed as normal daily usage. The prescription toothpaste used here is Rising® Denta 5000 Plus 1.1% Sodium Fluoride Prescription Dental Cream (5000 ppm Fluoride Plus Mild Cleaning System). The human tooth had been cleaned with distilled water and Acetone, and then recoated with this prescription toothpaste every day during the experiment before being stored inside a glass beaker. The tooth had been characterized by Optical Microscopy (OM) and Secondary Electronic Microscopy (SEM), before and after the experiment.

The outside of the human tooth is composed of two parts: crown covered by Enamel (Figure 1.) and root covered by Cementum (Figure 2.). The Enamel surface is smoother than Cementum. Micro-cell structures of 5~7 μm in diameter can be observed on Enamel, both in OM (Figure 1.) and SEM (Figure 3.)

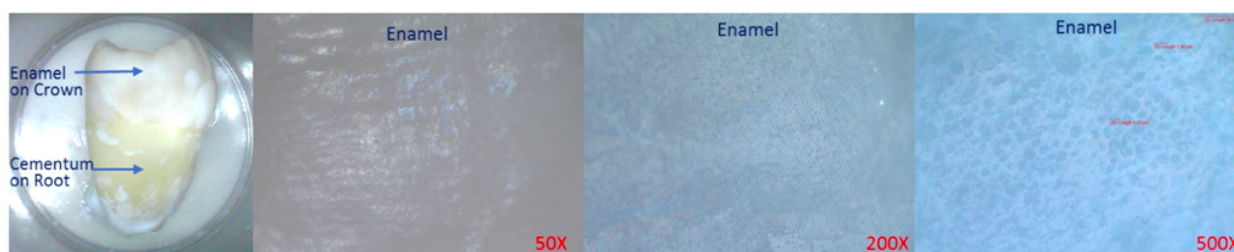


Figure 1. Enamel on Crown, under Optical Microscope (OM) before the experiment.

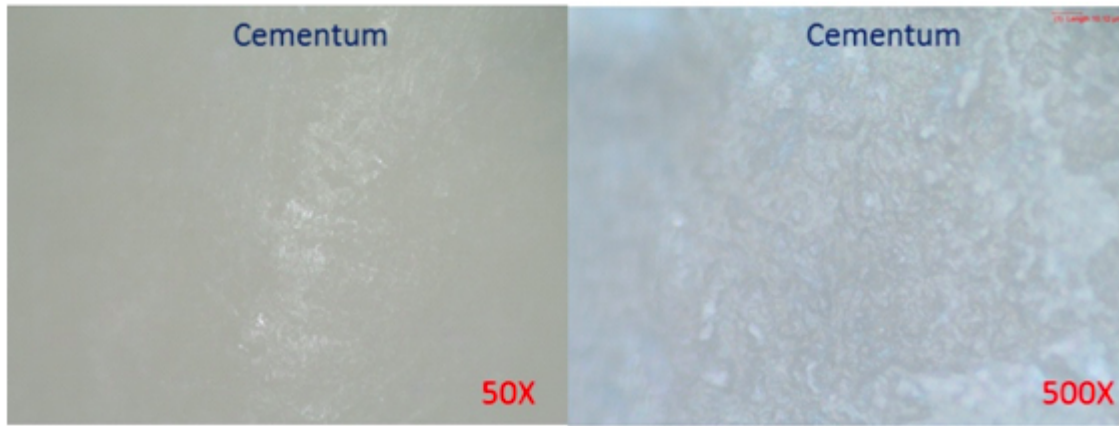


Figure 2. Cementum on Root, under Optical Microscope (OM) before the experiment.

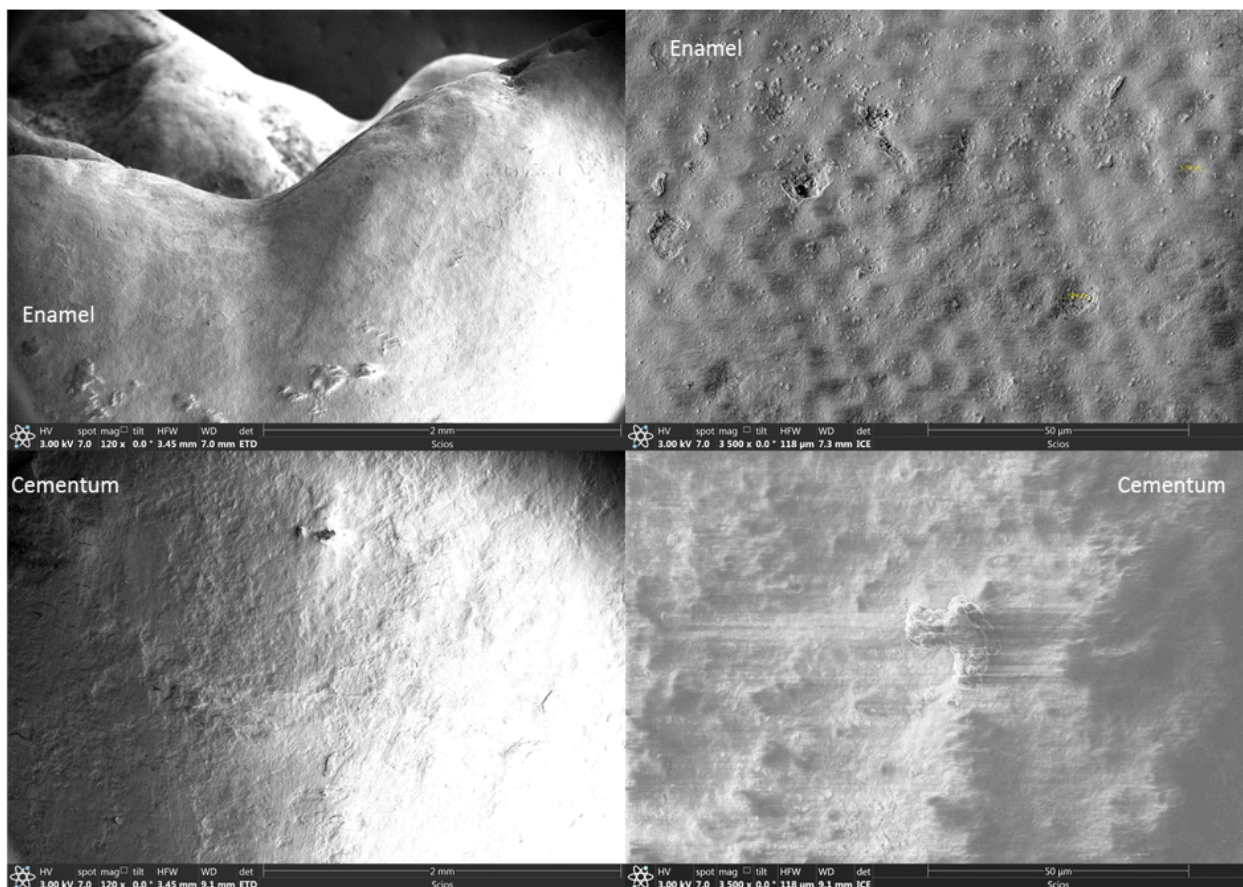


Figure 3. Enamel & Cementum, under Secondary Electronic Microscopy (SEM) before the experiment.

Results

After 2 months' immersion of the human tooth in the Rising® Denta 5000 Plus Fluoride toothpaste, the human tooth was washed clean and characterized with OM and SEM again to investigate any change on the tooth surface. The images taken are listed in the Figure 4 to 6 in the following. Notice that micro-cracks have been observed to appear on both Enamel and Cementum surfaces. Enamel surface started to show small groups of micro-cracks with stretching lengths of 50µm to 100µm (Figure 5.); while extensive micro-crack networks showed up on the surface of Cementum (Figure 6.). Obviously, the micro-crack density on the Cementum surface is a lot higher than the Enamel surface.

Discussion

The micro-cracks that appeared on the human tooth should have made the tooth weaker and more brittle. The cause of micro-cracks is understandable since there is a possibility that the Fluoride ion in the toothpaste could react and even erode the Calcium in the tooth over a long period of time.

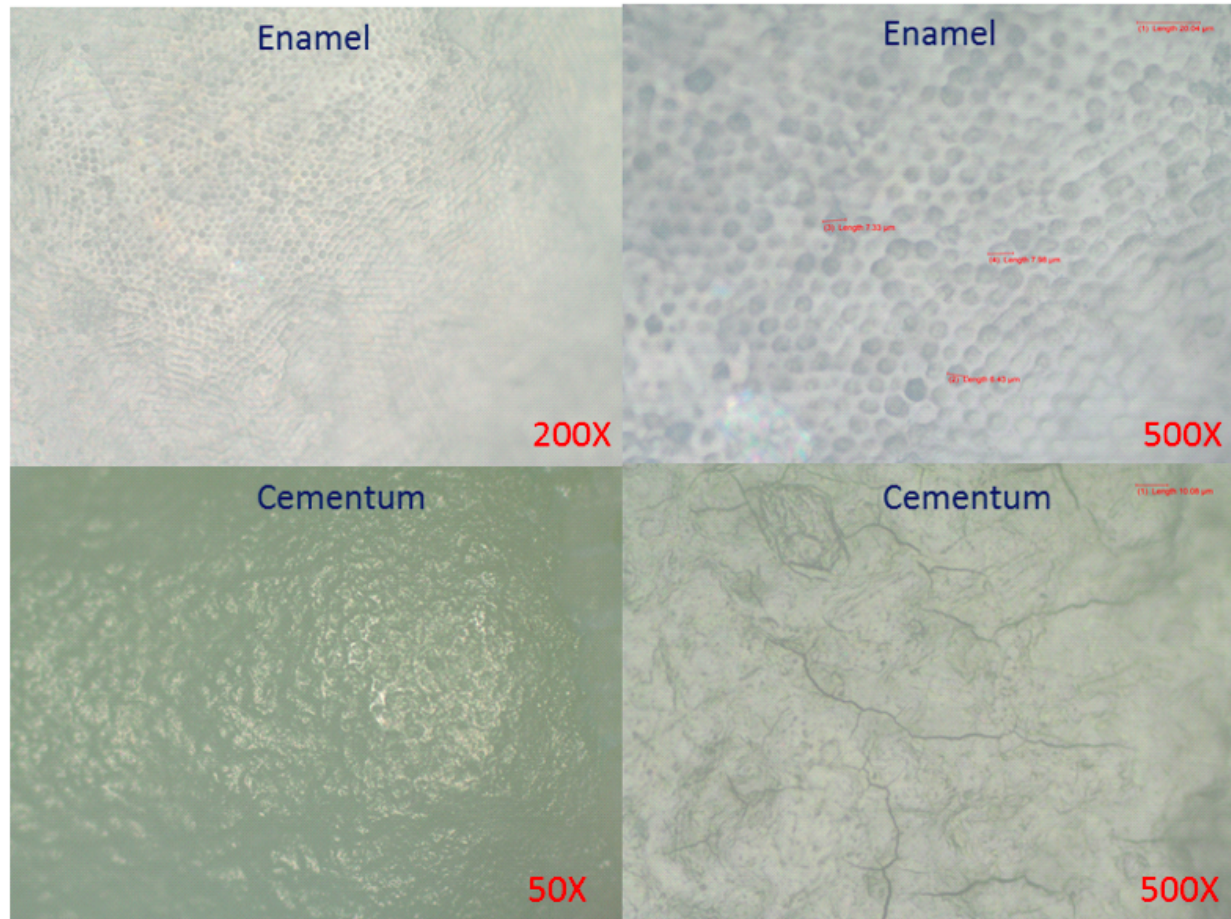


Figure 4. Enamel & Cementum, under Optical Microscope (OM) after 2months' experiment; Specially, cementum has shown crack networks.

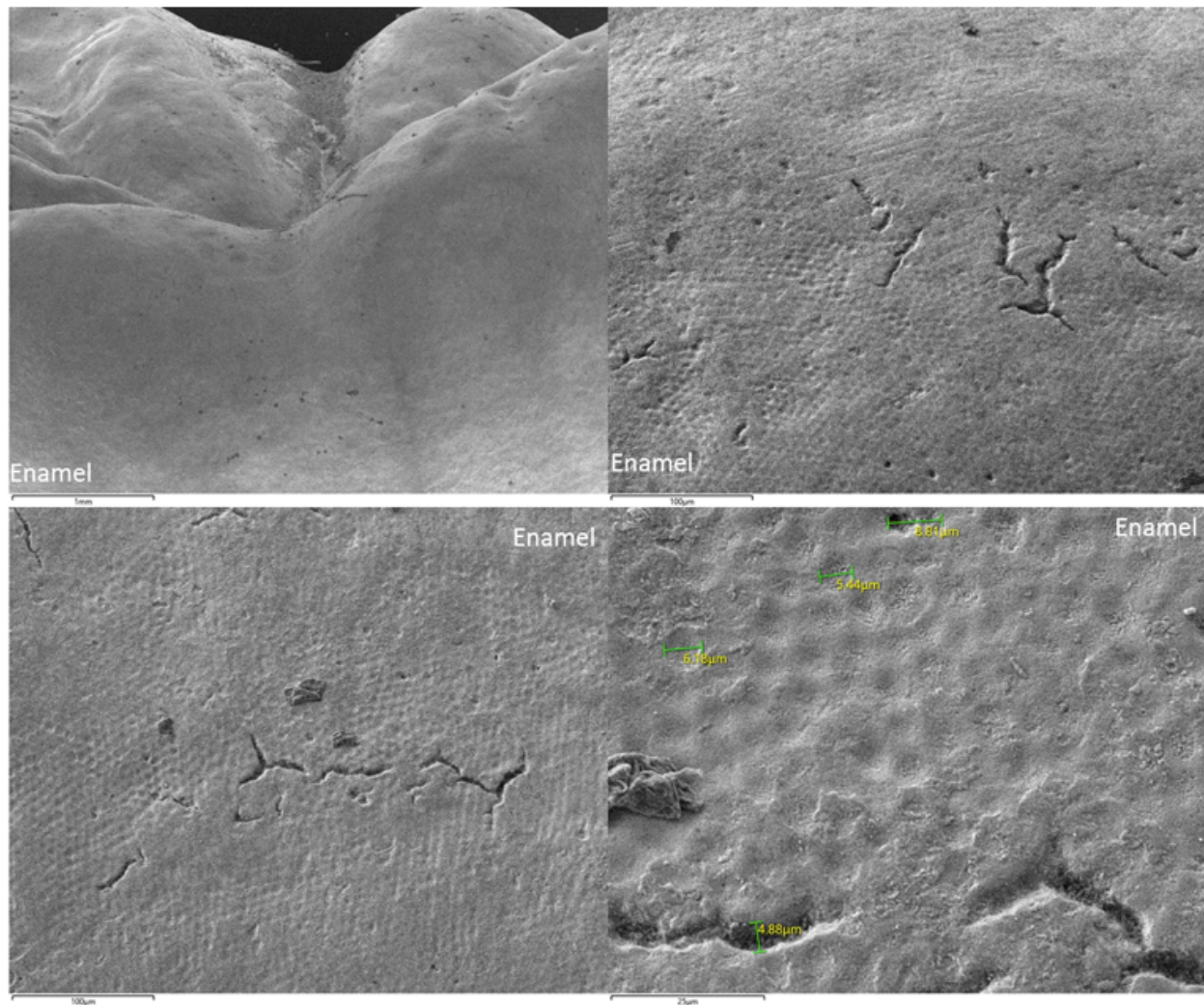


Figure 5. Enamel under Secondary Electronic Microscopy (SEM) after 2months' experiment; Enamel started to show small groups of cracks.

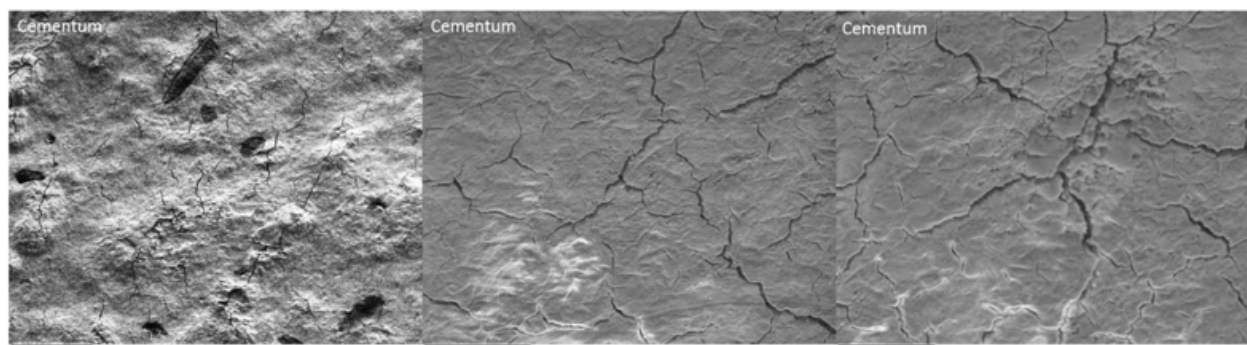


Figure 6. Cementum under Secondary Electronic Microscopy (SEM) after 2 months' experiment; Extensive micro-crack networks have shown up on the surface of the Cementum.

Conclusion

Fluoride is known to be a cancer-causing mineral that is commonly found in toothpaste and in some areas' tap water. Fluoride can be possibly dangerous at high levels where it can weaken your bones and teeth. It can also be toxic to the brain and nerve cells with enough exposure to fluoride.

In a 2-month experimental study of the long-term effect of Fluoride toothpaste on human

teeth, it is observed that micro-cracks have appeared on both Enamel and Cementum surfaces, which is a sign of tooth degradation. While Cementum surface has a much higher density of micro-crack networks, it seems that Cementum is more easily eroded by Fluoride than Enamel.

This study only investigated the effects of fluoride toothpaste on human teeth over a time interval (equivalent to 47 years' exposure) and did not include other outside influences. Factors such as chewing and the nutrients of the food we eat are some other factors that can affect the tooth's health even further. The PH value of food residues stuck between the teeth could be another factor to affect the pace of damage caused by Fluoride toothpaste to the teeth.

*

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Sources

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[Is Fluoridated Drinking Water Safe?](#)

Notes

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