

The “Tooth” Experiment

Part 1: Sipping Sugary Drinks and Acid Attacks

Acids are chemicals that are sometimes added to foods and drinks to alter taste and act as a preservative. One of the properties of acid is that it dissolves things.

When a person sips a sugary drink, an ‘acid attack’ occurs in the mouth for up to 20 minutes. The acid demineralizes the tooth during the attack and weakens the tooth. After about 20 minutes, saliva remineralizes the tooth and strengthens it. This balancing act becomes greatly challenged when a person snacks frequently on sticky foods, or sips regularly on sugar-laden drinks.

A case-in-point:

- A child takes a drink of pop and there is a 20 minute acid attack.
- The body is about to remineralize the tooth but the child takes another sip so there is another 20 minute acid attack.
- This pattern continues throughout the day. The balance is offset and the demineralization time outweighs the remineralization time and tooth decay begins.

The good news is that children can sip water all day with no worries of acid attacks on their teeth. However, if children are having their 1 serving (1/2 cup or 125 mL) of 100% fruit juice during the day (which contains a significant amount of naturally occurring sugar and is acidic), then they should drink it in as few sips as possible. The same applies to sugary drinks, when they are consumed as a once-in-a-while treat!

After having a sugary drink health professionals recommend rinsing your mouth with water, a fluoride mouth rinse or chewing sugarless gum. Any of these actions will help neutralize the acid found in the drink.

Interestingly, brushing of the teeth is not recommended. The enamel of the teeth is in a weakened state because of the erosion caused by the acid in a drink, so the mechanical abrasion of the brush actually exacerbates the problem.

Part 2: The “Tooth” Experiment

It is important to note that the “Tooth” Experiment does not simulate the processes occurring in the mouth after sipping a sugary drink. In placing the bone or “tooth” in different acidic sugary drinks, the only factor acting on the “tooth” is the acidity of the drink. There are no normal mouth bacteria present. Recall that when a child sips a sugary drink, the sugar interacts with the bacteria in the mouth to produce acid. Once this acid is made, it lasts for about 20 minutes, after which the saliva in the mouth neutralizes the acid, and the “acid attack” ends.

The “Tooth” Experiment does show the process of tooth erosion, whereby an acidic liquid chemically erodes away the hard mineralized surface of the “tooth”. Although the experiment cannot accurately capture all of the factors in the mouth that contribute to tooth decay, it is currently the best tool that we have to demonstrate the harmful effects on teeth. This hands-on approach gives an idea of the harmful effects of sugary drinks on their teeth.

In the spirit of experimentation, other drinks could be used, but we haven’t tested these or provided information in the resources. Plain milk may be used but it should be refrigerated and the experiment completed before the best before date, to simulate real drinking conditions. We trialed 100% orange juice and noticed that it often grew mold.

References

Sharon Melanson, Dental Hygienist, BC Interior Health Authority, 2008

Preparing Bones for the “Tooth” Experiment:



1. Shopping

Ask a butcher to cut a beef marrow bone (soup bone) into 1 cm thick slices.

You will get about 6 - 10 “teeth” per slice and to carry out the experiment as described, 6 pieces are necessary.



2. Cleaning

Soak the gristly bones in warm water overnight. Remove the gristle of the bone gently with a paring knife.



3. Cutting

To quickly cut bones into pieces, use a bolt cutter. You can also use a band saw or hit the bone with a hammer or a hammer and chisel (wear eye protection).

If you use a bolt cutter it works best when the bones are wet and soft.

Cut the bones in a safe environment as pieces may fly off in several directions.



Alternatives:

Demonstration using extracted adult teeth

Oral surgeons may be willing to save extracted adult teeth (usually un-erupted wisdom teeth) for classroom experiments. After extraction, the oral surgeon will rinse the teeth with water to remove blood before sending them to you. They should be stored in a dilute solution of bleach (9 parts water to 1 part bleach) to act as a disinfectant. Once received, the teeth can then be thoroughly cleaned with a toothbrush. Any remaining tissue will not interfere with this experiment. The teeth should then be stored in new dilute bleach solution until required. The teeth should be rinsed with water to remove traces of bleach before starting the experiment. For protection against such things as viruses, **the teacher should use gloves** when handling the teeth.

If using bone or extracted adult teeth is not appropriate for some students' culture and/or religion, or if you don't have enough time to do the entire experiment, teachers have also demonstrated the acidic nature of sugary drinks by placing a copper penny in an acidic liquid such as cola. Although the penny will become shinier, this is essentially due to the top layer of metal being etched away. This is an important distinction to be made as students could easily confuse this corrosive result with cleaning (or erroneously believing that drinking cola will clean their teeth).

**Children can sip water
all day with no worries of
acid attacks on their teeth**

