

Activity 2. “Tooth” Experiment Part II (25 mins)

Key Messages

- Some ingredients in sugary drinks other than sugar, such as acid and caffeine, can damage our health.

Objectives

- To discuss the results of the “Tooth” Experiment.
- To recognize that acidic and sugary drinks are damaging to teeth.

Preparation

You need:

- Paper towels
- Sink to drain off liquid
- Overhead 9: *Acid in Drinks*
- Overhead 10: “Tooth” Experiment Report
- Containers with “teeth” from “Tooth” Experiment Part 1

Also:

- Make overhead transparency of Overhead 11: *Tricky Questions for Advanced Scientists*.
- Review Backgrounder: “Tooth” Experiment (page 120).
- Review Assessment: *Observations of “Tooth” Experiment*.

Activity

Level 1 and Level 2

- Ask students to
 1. Drain off the liquid and place “tooth” on a paper towel.
 2. Find Handout 16: *Observation of “Tooth” Experiment*.
 3. Write down observations. Helpful cues are: change of colour, shape, texture, size.
 4. Draw a (coloured) picture of their “tooth.”
 5. Discuss in their group what happened to their “tooth” and write their conclusion.
 6. Compare results with “tooth” in water.
- Let each group share their observations and present them using Overhead 10: “Tooth” Experiment Report. Discuss if the hypothesis was supported by the observations.

Use the questions on Overhead 11: *Tricky Questions for Advanced Scientists* to check the students’ understanding. Show Overhead 9: *Acid in Drinks* again, while discussing results.

Assessment

To assess this activity, please review the assessment tool *Observations of "Tooth" Experiment*.

Activity Tips

After at least 2 weeks the students will probably have the following observations:

| | Texture | Colour | Explanation |
|---------------------|--|--|---|
| Water | No changes | No changes | <ul style="list-style-type: none"> Neither acid, nor colour in water |
| Apple Juice | Softer texture, squishy, moldy | Light brown | <ul style="list-style-type: none"> Teeth with some organic material on their surface make a great substrate for mold to grow, in the presence of moisture and sugar. Acid causes dental erosion. Teeth soften and dissolve. |
| Clear Pop | Softer, holes, dissolves, squishy | Slight changes, yellow | <ul style="list-style-type: none"> Food colouring in drinks stains and colours teeth. Acid causes dental erosion. Teeth soften and dissolve. |
| Diet Cola | Softer, holes, dissolves, squishy | Dark, almost black (same colour as cola) | <ul style="list-style-type: none"> Acid causes dental erosion. Teeth soften and dissolve. Food colouring in drinks stains and colours teeth There is no sugar in diet cola. It is the acid that causes erosion! |
| Cola | Softer, holes, dissolves, squishy | Dark, almost black | <ul style="list-style-type: none"> Acid causes dental erosion. Teeth soften and dissolve. Food colouring in drinks stains and colours teeth. |
| Energy Drink | Softer, holes, dissolves, squishy, shrinks | Dark, depending on brand: dark brown, red, yellow, green or black, white deposit | <ul style="list-style-type: none"> Acid causes dental erosion. Teeth soften and dissolve. Food colouring in drinks stains and colours teeth. |

It is important to note that the *"Tooth" Experiment* is different from what occurs in our mouths when we drink sugary drinks because:

- 1) The bone or "tooth" sits in each acidic sugary drink for 2 weeks or more, but we don't usually hold drinks in our mouths for this long;
- 2) When we place the bone or "tooth" in different acidic sugary drinks, the only factor acting on the "tooth" is the acidity of the drink. Recall that when we sip a sugary drink, the sugar interacts with the bacteria in our mouths 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.

Dental Erosion: the loss of the hard mineralized surface of the tooth structure due to chemical dissolution by acids

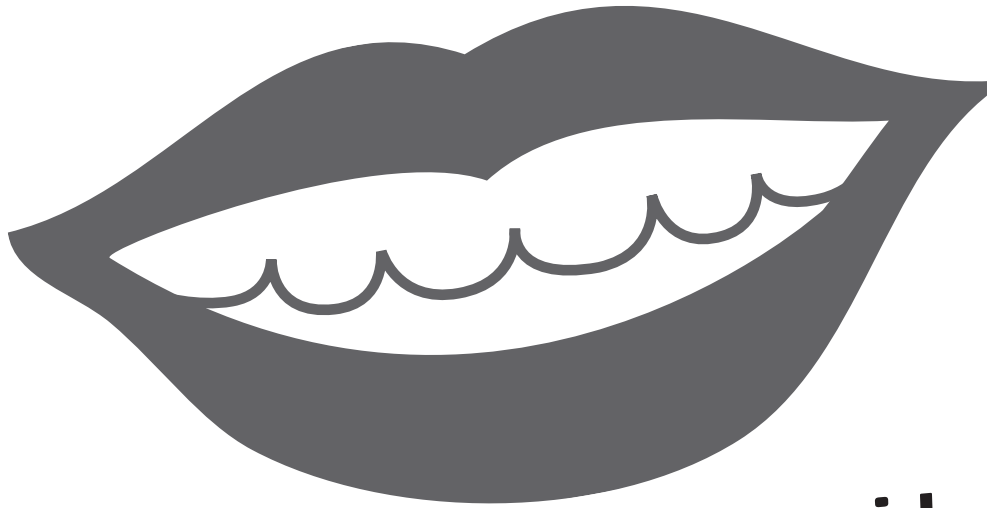
Acids that may be found in drinks:

- Ascorbic acid (also known as vitamin C)
- Phosphoric acid
- Citric acid
- Lactic acid

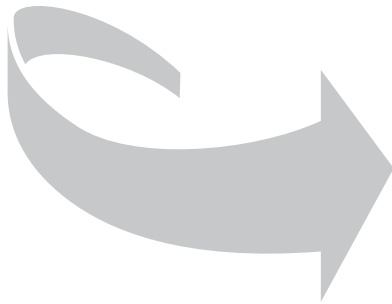
The Punchline!

The ingredients in some drinks (sugar and acid), along with naturally occurring bacteria in your mouth, affect your teeth. The combination of bacteria and sugar in sugary drinks form acid which can lead to tooth decay.

SIP SMART! BC ACID IN DRINKS



bacteria + sugar = acid



tooth decay!



**SIP SMART! BC
MEANS SIPPING WATER
- NOT OTHER DRINKS!**



| Drink | Hypothesis | Observation |
|--------------|------------|-------------|
| Regular cola | | |
| Diet cola | | |
| Clear pop | | |
| Energy drink | | |
| Apple juice | | |
| Water | | |

SIP SMART! BC™

OBSERVATIONS OF "TOOTH" EXPERIMENT

Name: _____

Drink being observed: _____

Use your senses to observe your "tooth". What does it look like? What colour is it? How big is it? What does it feel like? How does it smell?

➡ FIRST OBSERVATION:

| | |
|---|---|
| What I observe: _____ _____ _____ _____ _____ | Drawing of "tooth" before the experiment: |
|---|---|

Hypothesis:

Based on what I know, I think...

➡ FINAL OBSERVATION:

| | |
|---|--|
| What I observe: _____ _____ _____ _____ _____ | Drawing of "tooth" after the experiment: |
|---|--|

Conclusion:

SIP SMART! BC™ TRICKY QUESTIONS FOR ADVANCED SCIENTISTS



| Drink | Conclusion (= explain what happened to your “tooth”) |
|--------------|--|
| Regular cola | |
| Diet cola | |
| Clear pop | |
| Energy drink | |
| Apple juice | |
| Water | |

Tricky questions for advanced scientists:

1. Which drink damages our “teeth” the least?

2. If we want a sugary drink once in a while, what can we do to reduce the “acid attack”?

3. Diet Pop has no sugar. Why does the “tooth” in diet cola look exactly like the “tooth” in cola?

Teacher Assessment Rubric

➤ Observations of "Tooth" Experiment

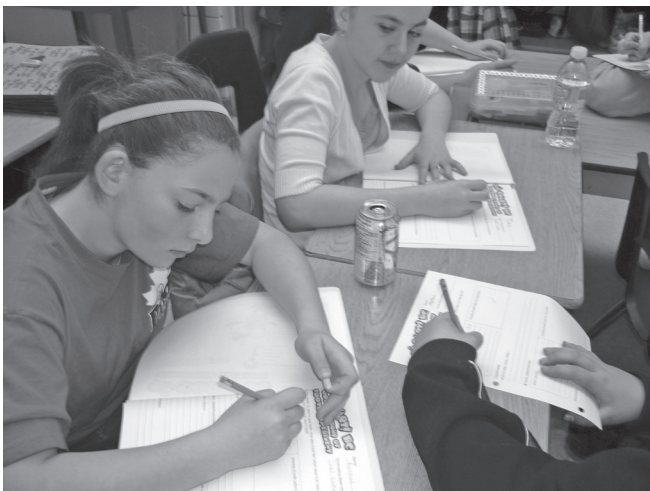
Level 1 and Level 2

Name: _____

| | | | | |
|---|------------|---|---|---|
| First observation addresses colour, texture and shape of "tooth" | 8 | 6 | 4 | 2 |
| First drawing matches first observation | 8 | 6 | 4 | 2 |
| Identifies ingredients of assigned drink in hypothesis (Does it contain sugar or acid?) | 8 | 6 | 4 | 2 |
| Predicts impact of ingredients on "tooth" | 8 | 6 | 4 | 2 |
| Second observation addresses clear differences in colour, texture and shape of "tooth" | 8 | 6 | 4 | 2 |
| Second drawing matches second observation | 8 | 6 | 4 | 2 |
| Conclusion demonstrates understanding of how the ingredients in the drink contribute to "tooth" erosion and theoretical decay | 8 | 6 | 4 | 2 |
| Score | _____ / 56 | | | |

Key:

- 8 = Exceeding expectations
- 6 = Meets expectations
- 4 = Approaching expectations
- 2 = Not yet meeting expectation



SIP SMART! BC
OBSERVATIONS OF "TOOTH" EXPERIMENT

Name: _____
Drink being observed: _____

Use your senses to observe your "tooth". What does it look like? What colour is it? How big is it?
What does it feel like? How does it smell?

● **FIRST OBSERVATION:**

What I observe:

Drawing of "tooth" before the experiment:

Hypothesis:
Based on what I know, I think...

● **FINAL OBSERVATION:**

What I observe:

Drawing of "tooth" after the experiment:

Conclusion:

Handout 16: Observations of "Tooth" Experiment

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 a sugary drink during the day (e.g. fruit juice or pop), 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. Anyone 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