2. Tantalizing toothpaste

2 hours

Children test a range of toothpaste types for abrasion, taste, colour, consistency and smell. They establish what is necessary in toothpaste and which ingredients help to achieve this.

OBJECTIVES

- To understand the function of toothpaste.
- To undertake tests to find the most effective toothpaste.
- To compare different toothpastes by analysing their effectiveness.

RESOURCES

(Per group of 4 children unless otherwise stated)

- Activity sheet 2a-c
- Activity sheet 2d (optional - extension/homework)
- 3 large tubes of different types of toothpaste for the class, e.g. whitening, tartar control, paste or gel, different colours/flavours
- 3 small white ceramic tiles[1]
- 1 permanent marker for the class
- 2 new toothbrushes
- Stop clock or watch, or the second hand of the class clock

ADVANCE PREPARATION

Coat or colour a small patch on each ceramic tile with the permanent marker pen.

There are four mini-activities for Activity 2 with implications for classroom organisation. Here are some options:

1. A circus of investigations set up around the room, which the children visit in turn.
2. Each group carries out a different test and shares them.
3. Each child in a group is given the responsibility to carry out a different test on toothpaste.
4. The whole class works through each activity sequentially.

1 These can be bought cheaply as 'seconds' from DIY stores.

INTRODUCING THE ACTIVITY

Look at the concept cartoons (Activity sheet 2a-b). The children discuss the cartoon statements in their groups, ticking the ones they agree with and crossing out the ones they do not. Lead a discussion about which statements the children agree with and importantly, why they agree. Discuss the last activity; explaining how cleaning our teeth helps make our teeth and gums healthier.

MAIN ACTIVITY

Introduce the following tests to compare types of toothpaste, in order to find out what the children consider is the best toothpaste and find out how it fights tooth decay. Discuss key vocabulary, e.g. abrasive (scratchy, grating, gritty, rough), consistency (firmness, thickness). Display these in the classroom.

Activity sheet 2c provides a table for the children to record their measurements, observations and preferences. Differentiate between scientific observations such as carefully describing the smell, and expressing opinions such as their favourite taste is mint. Explain that the toothpaste manufacturers would have to do similar tests.

Colour observation: The children describe the toothpaste colours and which they prefer. Do any colours put them off?

Smell observation: They select 1-2 words to best describe each smell, and add a ☺ or ☹ to show preference.

The children then establish which of the three toothpastes smell the best. Discuss how important smell is to toothpaste. What would the children like toothpaste to smell like?

Scratch test: The children test each toothpaste type by timing how long it takes to remove the permanent marker from the ceramic tile. Establish that the permanent marker represents plaque. The toothpaste that removes the marker the quickest will be the most abrasive.

Discuss the ideal circular motion for cleaning teeth and why it is better for your teeth than scrubbing.

Thickness test: The children put some toothpaste on a toothbrush and try and shake it off into a container. The higher the number of shakes, the thicker the consistency. Establish that consistency is important for the toothpaste to stay on the brush and to evenly spread over the teeth. This can be quite a messy test.

Safety note

The children should wear goggles to prevent toothpaste getting into their eyes. They may prefer to wear aprons to protect their clothes.

PLENARY

The children then draw a conclusion by considering all the properties of each toothpaste.

The class then pool all their choices, and discuss the toothpastes to find out whether the class can select one preferred toothpaste.

Remind the children that preferred smells and tastes can differ from one person to another.

Toothpaste manufacturers could be asked how they select new flavours/smells, e.g. do they ask 10, 100 or 1,000 people for their preferences?

Look back at the concept cartoons to establish that brushing our teeth has several different purposes, e.g. brushing scrapes some of the plaque from the surface of our teeth.

EXTENSION/ HOMEWORK

Toothpastes contain different ingredients to make them work successfully. The children could use Activity sheet 2c to match the function to the active ingredient. The table below shows some active ingredients and their function.

Type of ingredient	Function
Fluoride	Strengthens tooth enamel against decay.
Abrasive substance (such as silica)	Helps scrape off plaque from the smaller nooks and crannies that the toothbrush alone cannot reach.
Stain remover	To help to whiten teeth.
Thickening agent (such as cellulose)	So that it forms a paste, stays on the toothbrush and can be easily applied to our teeth.
Flavouring	To mask the flavours of other ingredients and to make our mouths feel fresh and clean.

Appendix 2 provides a more comprehensive explanation and table as well as the features and functions of different types of toothbrush.

Appendix 2: The active ingredients of toothpaste

WHAT IS IN TOOTHPASTE?

Almost all commercial toothpastes start with mild abrasives and detergents, as well as the near-universal ingredient, fluoride. After that, toothpastes vary significantly.

Here is a list of active ingredients in toothpaste:

- Fluoride
- Antibacterial agents, are used to control plaque (Triclosan)
- Desensitising agents (potassium nitrate)
- Anti-tartar agents (pyrophosphate)
- Sodium bicarbonate (baking soda)
- Enzymes, to enhance the antibacterial properties of saliva
- Xylitol, a non-sugar sweetener, which reduces levels of cariogenic (decay causing) bacteria in the mouth and enhances remineralization.

Natural toothpastes may contain a variety of ingredients - anything from oil of ginger to seaweed extract.

Inactive ingredients:

- Water
- Detergents, to make the toothpaste foam
- Binding agents
- Humectants to retain moisture
- Flavouring, sweetening, and colouring agents like peppermint, spearmint, cinnamon, wintergreen, and menthol
- Preservatives
- Abrasives for cleaning and polishing.

Toothpaste is regularly being improved. Currently available are anti-cavity toothpastes, extra- whitening toothpastes, toothpastes with mouthwash, toothpastes for sensitive teeth, toothpastes with stripes, clear toothpaste, even liver flavoured toothpaste for dogs.

HOW DOES TOOTHPASTE WORK?

There are several different types of toothpaste being commercially manufactured today. All of these are based on some sort of abrasive, intended to scour off plaque, rotting food, and various other substances from the teeth and surrounding area. However, there are several fundamental differences between different toothpaste types, depending on specific ingredients that have been added.

Fluoride toothpaste is by far the most popular toothpaste. Manufactured by the major toothpaste companies, this toothpaste's active ingredient is a type of sodium fluoride. Sodium fluoride creates a chemical bond with the teeth and hardens the enamel against decay.

Sodium bicarbonate (baking soda) is added for taste and feel in the mouth. It combines with acids to release carbon dioxide gas, adding to the foam produced by brushing. It is a mild abrasive. It may reduce the numbers of acid loving bacteria in the mouth, although this effect lasts only as long as the mouth stays alkaline.

Sweeteners such as sodium saccharin are added for taste. Other flavours are usually strong essential oils found in the mint family. It must have a strong enough flavour to hide the bad tastes of decaying bits of previous meals, and the awful taste of some of the other ingredients, such as detergents and phosphates.

Toothpaste must have thickeners to enable it to stay on the toothbrush, squeeze out of the tube, but also retain moisture so the toothpaste does not dry out if the top is not replaced. It must have detergents to remove fatty films, water softeners to make the detergents work better, and sweeteners, preferably non-nutritive, so bacteria are not encouraged.

Sodium carbonate peroxide is added as a whitener. It breaks down into sodium carbonate (washing soda) and hydrogen peroxide. The hydrogen peroxide bleaches the teeth, and kills germs.

The anti-bacterial agent triclosan is added to kill plaque-forming microbes.

SUMMARY OF TOOTHPASTE INGREDIENTS AND THEIR FUNCTIONS.

The following table shows the different components of toothpaste, their functions and examples of ingredients that serve that purpose.

Component	Function	Examples
Polishing agent	Abrasive which helps in the removal of plaque and surface tooth stains without scratching the tooth enamel or dentine.	Calcium carbonate (chalk), hydrated silicas, dicalcium phosphate, alumina.
Humectant	Holds water in the toothpaste, helps dissolve some of the other ingredients, provides gloss to the paste, also imparts some sweetness and 'mouthfeel' to the product.	Glycerine, sorbitol.
Gum thickeners	Controls consistency, making toothpaste flow onto brush and disperse easily into the mouth. Gums also bind the solid and liquid matter together to maintain the integrity of the paste.	Sodium carboxymethylcellulose, carrageenan, xanthan.
Foaming agent	Detergent; provides foam that eases the removal of food debris and improves dispersion of the paste in the mouth.	Sodium lauryl sulphate, sodium methyl cocyl taurate.
Flavour systems	Important: makes product pleasant to use, fresh tasting. A solubiliser emulsifies the flavour into the aqueous base.	Commonly peppermint and spearmint, and a sweetener.
Active ingredients	Protect against tooth decay, gum disease, tartar and treat sensitivity.	Very diverse, e.g. fluoride systems (sodium fluoride, sodium monofluorophosphate), antimicrobials (Triclosan, zinc citrate), tartar agents (sodium and potassium pyrophosphates), sensitivity agents (potassium nitrate, strontium acetate and strontium chloride).
Preservatives	To preserve the product and ensure a long-life.	Sodium propyl paraben, sodium methyl hydroxybenzoate, potassium sorbate, benzoic acid.
Colouring	Important for visual appeal.	Various dyes.
Water	Solubilize and carry some of the active ingredients, and make up liquid phase of toothpaste.	

Table to show the features of different types of toothbrush:

Toothbrush characteristics	Function
Firm, medium or soft bristles	They are harsher or gentler on the teeth and gums. Firm bristles remove more plaque but can damage the tooth surface and gums.
Flexible/rigid handles	Some are flexible to reach awkward parts of the mouth
Compact heads, larger heads	Compact heads often can reach into more awkward parts of the mouth. Larger heads brush more plaque off and last longer.
Indicator	Some toothbrushes have an indicator that changes colour to show when it is time to change toothbrushes.
Different sized and types bristles	The different bristles have different functions in tooth cleaning. Some clean the tooth, the others reach into spaces between teeth.

Table taken from the GlaxoSmithKlein Oral Information Pack.