

WHAT YOU NEED TO KNOW ABOUT DENTAL CARIES AND HOW TO PREVENT THIS DISEASE

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YOUNG REVIEWERS:



ABOLFAZL

AGE: 13



ARYAN

AGE: 13



ELLIOT

AGE: 12



MEHDI

AGE: 12



REZA

AGE: 13



RONI

AGE: 12

The human mouth is home to many microorganisms, both heroes and villains. The most famous villains feed on the sugar we eat. Sugars make the villains strong, and the villains can hurt our teeth and cause dental caries (cavities). Cavities often happen when we eat too many candies and do not brush our teeth which make our teeth extremely weak. To prevent cavities, we can change our eating behaviors and improve our oral hygiene habits, which include brushing our teeth with toothpaste and using dental floss. It is important to ensure that our teeth are strong and healthy. After all, who does not want to have healthy teeth?

CHARACTERISTICS OF THE MOUTH

The human body is constantly inhabited by tiny creatures called microorganisms, which are also present everywhere in the environment. There are many different kinds (species) of microorganisms, and each species can live in (colonize) a different environment [1]. Each part

MICROBIOME

The microbiome is the collection of all microorganisms, such as bacteria, fungi, viruses that naturally live on our bodies.

SOFT SURFACES

Soft surfaces in the mouth are the mucosas which are composed of the epithelial cells and connective tissue (lamina propria).

Figure 1

Soft vs. hard surfaces of the mouth. Different surfaces support the growth of different types of microorganisms.

HARD SURFACES

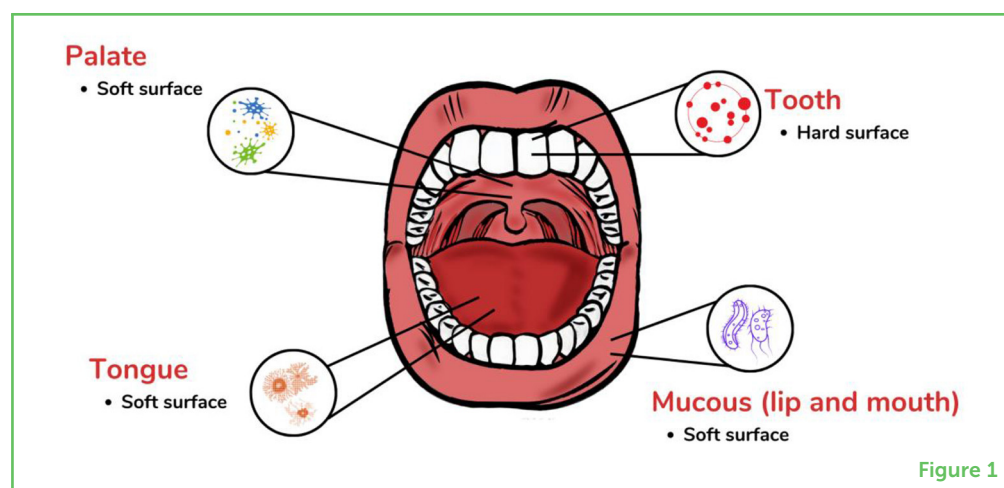
Hard surfaces in the mouth are mineralized structures that form the teeth and are exposed to the oral environment.

DENTAL BIOFILM

Layers adhered to the surface of teeth composed of microorganisms, nutrients from saliva, and other substances that promote the growth of microorganisms.

of the human body has unique and important qualities that favor colonization by certain species of microorganisms [2]. The entire community of microorganisms living on and inside the human body is called the **microbiome**.

You can think of the microbiome as the population of a city (the body), with many different families living there. Just like there are different neighborhoods in a city, the microbiome of the mouth, for example, is different from that of other parts of the body. Even more interesting, some parts of the mouth are more inhabited by microorganisms than other parts are. There are two main types of neighborhoods (surfaces) within the mouth where microorganisms can live: **soft surfaces** (such as the lips, cheeks, palate, and tongue) and **hard surfaces** (such as the teeth) (Figure 1).



Residents of soft surfaces are affected by a process known as continuous desquamation, which means that cells on the surface peel to renew the tissue. Imagine that you have a box wrapped with multiple layers of gift wrapping. You remove one layer, and then another layer, and so on to get to the gift. The continuous scaling of these mouth surfaces makes it difficult for microorganisms to accumulate. On the other hand, the teeth that are hard mineralized structures are easily colonized by microorganisms because tooth surfaces do not have multiple layers that are regularly removed. Thus, tooth surfaces favor the accumulation of microorganisms.

In addition, the mouth contains a transparent liquid called saliva, which influences which microorganisms can colonize the mouth and serves as a source of nutrients for those microorganisms, helping them to grow. The nutrients in saliva mix with other substances on tooth surfaces (such as the food we eat) to form a sticky covering hugging the teeth, called the **dental biofilm**. Microorganisms can easily stick to the dental biofilm [2].

DEFENDING OURSELVES AGAINST MOUTH VILLAINS

The mouth has several weapons to defend itself against mouth villains. These include substances that make the teeth stronger and others that help loosen microorganisms that are stuck, so that they can be swallowed along with the saliva. These protective substances prevent both invasion by dangerous microorganisms and help to destroy microorganisms that are already present.

Other microorganisms are great heroes that usually help us to maintain a healthy mouth. However, when there is a change in the environment (for example, if sugary foods are eaten too frequently), certain microorganisms grow stronger and disturb the natural balance of microorganisms in the mouth. The “good guys” are then replaced by villains that favor the development of diseases, in this case, **dental caries** [1, 3].

WHAT IS DENTAL CARIES?

Dental caries, more commonly called cavity, is a disease caused by the weakening (called **demineralization**) of teeth by acids released by the microorganisms present in the dental biofilm. Imagine each tooth as a house and the microorganisms as the wind. When we eat too many sweets and do not brush our teeth, it is as if the little house becomes weaker and weaker. As the wind grows stronger, small holes begin to form in the house’s structure. If we do not have the help of a shovel and a sand bucket (toothbrush and fluoride toothpaste) to make the house strong again, the house breaks down—and tooth decay occurs.

Tooth decay begins as a white spot on a tooth, which grows into a hole. When tooth decay is present, we may feel discomfort while eating. As the hole increases in size, the pain often becomes worse and, if the hole is not filled, the pain may stop us from eating or disturb our sleep.

IS DIET RELATED TO DENTAL CARIES?

What we eat is one of the main factors influencing the development of dental caries. Eating sweets is the main cause of dental caries, so it is important to think about how often you eat sugary foods, and how much of them you eat [4]. Sugary, sticky foods are difficult to remove from the teeth. Also, if these foods are soft we chew them less, which leads to decreased production of saliva. This helps the sugary, sticky foods to stay in contact with our teeth for longer [2]. When this happens, the white part of the tooth, known as the **enamel**, becomes the target of acids produced by microorganisms.

DENTAL CARIES

Dental caries develop when bacteria in the mouth use sugar to produce acid that demineralizes the hard tissues of the teeth.

DEMINERALIZATION

Demineralization is the process of removing minerals (ions) from hard (mineralized) tissues of the tooth.

ENAMEL

The hard mineralized structure that covers the tooth.

Therefore, a healthy diet, including all the food groups, is fundamental to maintaining good oral health [5, 6]. We must rely on water, proteins, lipids, vitamins, fiber, and minerals to complete the armor that protects us against caries and keeps our teeth strong and healthy [2].

HOW CAN WE HELP KEEP OUR TEETH HEALTHY?

We can defend our teeth from injuries during the initial attacks by microorganisms by reducing our consumption of sweets and by brushing our teeth correctly [5]. Brushing our teeth with fluoride toothpaste helps to protect them and make them strong again, through a process called **remineralization**. In remineralization, the tooth surface that was lost (demineralized) receives a new wall of minerals, which strengthens the tooth (Figure 2) [2, 3]. Remineralization occurs in white spot carious lesions, but if a hole is formed tooth need to be filled out with dental materials.

REMINERALIZATION

Remineralization means the redeposition of minerals lost by enamel and is synonymous with enamel repair or rehardening.

Figure 2

The demineralization-remineralization process. When we eat too many sweets and do not brush our teeth, our teeth become weak and lose minerals (demineralization) due to the acids produced by microorganisms. To win this battle, our teeth need help from a toothbrush, fluoride toothpaste dental floss, and all kinds of fruits and vegetables. When we take care of our teeth this way, remineralization can occur, creating a new wall of minerals that makes our teeth strong.

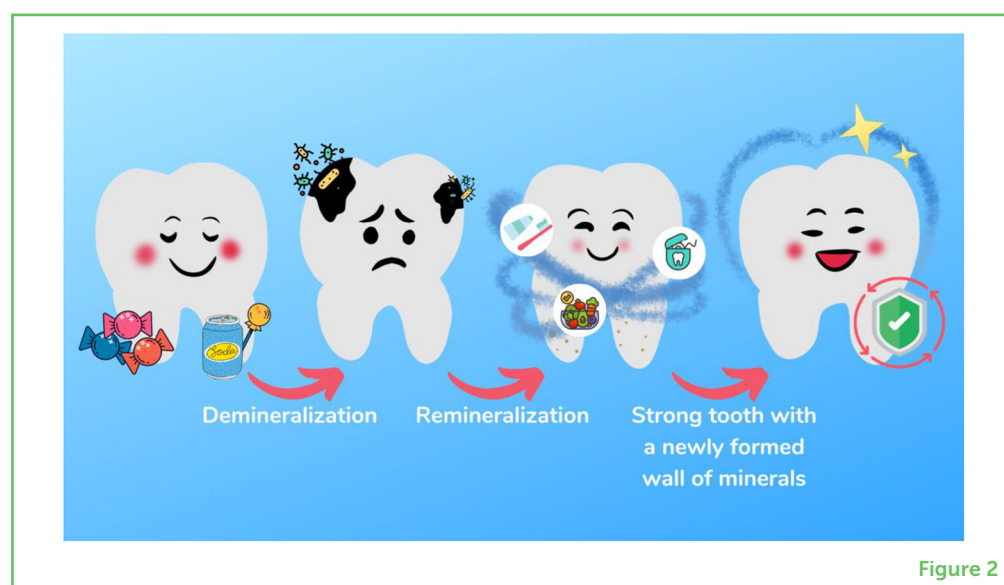


Figure 2

One of the best things we can do to prevent dental caries is to brush our teeth at least twice a day—especially after meals. It is important that brushing is done correctly and with a toothbrush, toothpaste, and dental floss. The toothpaste should contain at least 1,100 parts per million (ppm) of fluoride, as this is a good amount of fluoride for teeth remineralization [5].

Why use fluoride toothpaste? Fluoride dissolves less than other minerals during demineralization, and it can bind to parts of the tooth to form a super-protective layer of calcium fluoride. This helps our teeth face battles against the acid-producing microorganisms that eat sugar. It is important to understand the amount of toothpaste that is needed each time we brush our teeth. For children under 3 years of age, a quantity of toothpaste the size of a grain of raw rice is enough.

DENTAL FLUOROSIS

Dental fluorosis is disorder in enamel mineralization caused by ingestion of excessive fluoride during tooth formation.

Figure 3

Correct toothpaste amounts for various age groups. To ensure that our teeth are always strong, we should use the correct amount of toothpaste. For children under 3 years of age, the amount should be equivalent to the size of a grain of raw rice. For children aged 3–6 years, the amount should be the size of a pea. Children aged 7 and older and adults should use ~2 cm of toothpaste.

For children aged 3–6 years, the amount of toothpaste should be the size of a pea [3]. For children over 7 years and adults, ~2 cm of toothpaste can be used (Figure 3). High amount of toothpaste should never be used by children. When a high amount of toothpaste is used and swallowed by young children it can cause a defect in permanent teeth that are growing inside the bones known as **dental fluorosis**.

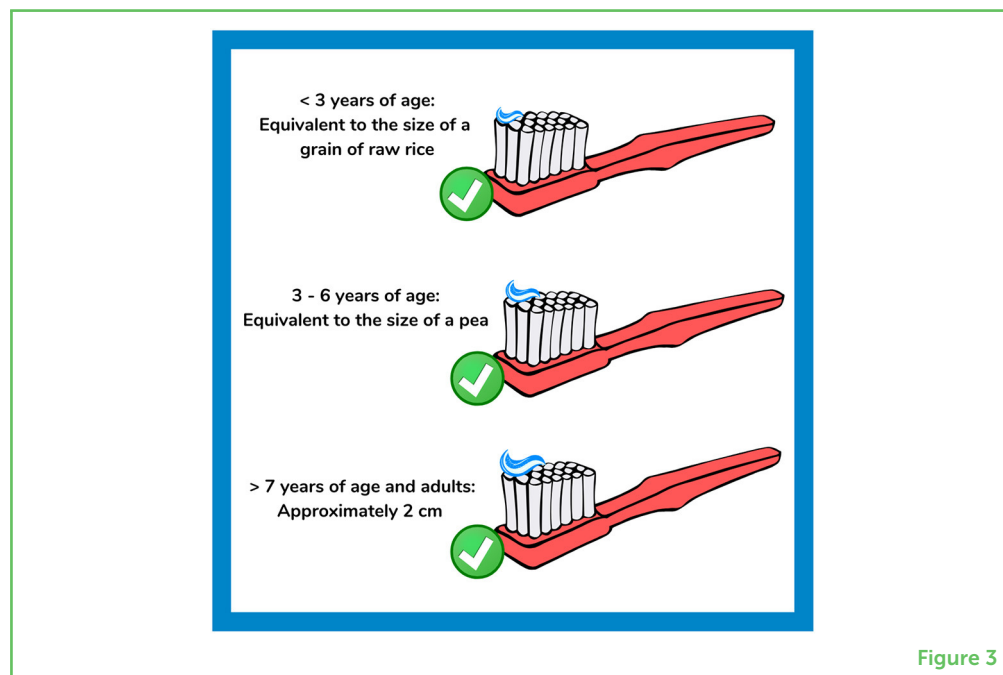


Figure 3

When you look at your mouth in the mirror, you can see the teeth, the tongue, and the pink tissue under the teeth, known as the gums. For young children, tooth brushing can be done by placing the brush over a set of teeth and then brushing with gentle, circular movements. Older children should start brushing from the gums and move toward the tooth. For the top teeth, move your toothbrush as if you were sweeping the tooth from top to bottom. For the bottom teeth, do the same thing, but from bottom to top. For the chewing surface, move the toothbrush back and forth [3].

It is important to remember to use dental floss, which cleans the spaces that you cannot get to with a toothbrush. Dental floss helps to remove the remaining food and debris from between teeth. The right way to use dental floss is to wrap it around the index fingers of both hands, then pass it between the teeth, hugging each tooth with the floss, making a movement similar to the shape of the letter "C." Do this for each tooth and do not use too much force; otherwise, the gums will hurt.

If we brush our teeth, reduce sugar consumption, and visit the dentist regularly, we can keep our teeth healthy and safe from the villains that make them weak.

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YOUNG REVIEWERS



ABOLFAZL, AGE: 13

A lively and encouraging boy, interested in interdisciplinary sciences (especially in AI). Ball sports addict :) In love with the books that make him feel alive!



ARYAN, AGE: 13

Hi, My name is Aryan. In the Scientific fields, I am interested in astronomy and physics. I had some activities and studies in these fields. Recently, in biotechnology and bioengineering, I have been interested in applying mathematics and technology in biology. I love the Science fiction novels like the Dune Novel.



ELLIOT, AGE: 12

Elliot loves almost all science, especially cell biology, engineering and robotics/coding. He also loves playing soccer, playing cello and doing almost anything outside.



MEHDI, AGE: 12

Hi, I am Mehdi. I am 12 years old now, and I have many dreams and many ways to go. I hope 1 day everyone remembers me with my helpful discoveries or research. I am interested in animals. I do some research about them. My favorite sport is ping pong.



REZA, AGE: 13

Hi I am Reza. I am 13-year-old. My favorite sport is volleyball. I like reading books, and I have read many detectives and crime books. I love biology, and I am interested in discovering new information about it. I hope to be able to achieve higher degrees in the new future.



RONI, AGE: 12

Roni loves to read, write and play soccer. She also enjoys singing. She is very creative and loves to design and construct all sorts of things.



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