**Preventive sheet nom. 2**

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**What is dental caries?**

It's a process affecting the mineralized tissues of teeth ; enamel and dentine … this is it in a simple way !

**How does it occur?**

They thought it was a very complex issue until the 18th and 19th centuries, they believed that caries started from the inside of the tooth structure towards the outside , however it wasn't true.

Caries is mostly multifactorial depending on host , tooth structure , bacteria, diet, oral hygiene and plenty of other factors.

**Again how does it occur?**

It occurs by the production of acids.

Acid is the main reason that causes destruction, and that's how the acidogenic theory was proposed by W.DMiller in the 1890's .

**Acidogenic theory:**

A theory describes the cause of dental caries, first postulated by Willoughby D. Miller in 1890, which stated that non-specific bacteria in the plaque cause fermentation to sugars in carbohydrates to produce acids that decalcify tooth structure .

Thus acid is very important in the etiology of dental caries.

They discovered that by simple experiments on animals specially rats in 1950(( you don't have to memorize the names and numbers as they are example )) and they found that caries occurred by the presence of food in the mouth, so basically without food caries won't occur.

In 1954 they looked for the role of bacteria on 2 groups of rats.

1st group: were germs free,food is driven directly to the stomach , absolutely no bacteria, no caries were found.

2nd group: with germs and oral feeding , and cariogenic diet , bacteria, caries developed.

\*\* Bacteria must be present in order for the caries to develop.

**Which bacteria ?**

Cariogenic bacteria.

\*\*The characteristics of cariogenic bacteria:

1- Acidogenic: to be able to produce low Ph to demeniralize the tooth… the basic characteristic .

2- To be able to survive in low ph.

3- Adhesive production, to stick to tooth structure.

\*\***What are the cariogenic bacteria:**

1- mutans streptococcus.

Other types of bacteria can cause caries not necessarily mutans streptococcus :

2- Lactobacilli : leads to the progression of caries. Gram positive rods

3- Actinomyces.

 These types of bacteria can be used as markers for caries risk assessment. If we have saliva sample with high percentage of these bacteria , this indicates that this pt is a high risk pt .for caries

**The location of these bacteria is very important factor also**

We are concerned about the bacteria that is responsible for the dental caries and existing near the tooth which is the dental plaque, and not those found in saliva.

**The prevalent areas of caries are:**

1- Interproximally where plaque accumulates.

2- Fissures.

3- Cervically.

4- at the erosion area .

Plaque mostly contains 70% bacteria, salivary mucoid, polysaccharides, and epithelial cells as well.

One way of removing plaque is mechanically by tooth brushing, rinsing it by water is not enough, and the other way is chemically.

**There are 3 Hypothesis relate plaque to dental caries**

**1- Specific plaque hypothesis:**

It states that there are more than 500 species of bacteria in the oral cavity (oral flora) out of these species only a very limited number involved with caries, which means if we can target a specific bacteria with a specific antibacterial therapy ,that would be enough to stop caries, unfortunately this is not true because there's no vaccine or medication that can do that.

**2- Non-specific plaque hypothesis:**

It says that plaque is a microbial community and the disease results from the interaction of all the species, which means that we can remove caries simply by removing the bacteria, which not true also

**3- Ecological plaque hypothesis:** the most accepted one =)

It was described by a microbiologist.

It states that the disease results from a shift in the balance of the plaque in the microflora.

Bacteria which is potentially cariogenic exist in those who are free of caries and in people who have caries, but in different numbers.

When shifting in the balance happened toward the cariogenic bacteria , caries will occur .The disease can be controlled by interfering in the factors responsible for shifting the microflora, preventing the bacteria to increase in number.

The bacteria is acidogenic, so the shift will occur if the environment is acidic, and many of these bacteria will survive driving the shift more towards causing caries.

Thus it's all about the environment, that's why it's called ecological hypothesis.

This is the right hypothesis.

Plaque is not simply a bacteria that can be seen in a culture.

The micro-organisms are arranged in micro-economies, it takes more than action of antibiotic or antimicrobial agent to be simply killed. It's not simple like that bacteria in petry dish !

**Factors to be considered in dental caries formation:**

1- Saliva 2- sugars 3- Plaque 4- Free enamel .

If a person ate sugar, it will lead to plaque, the bacteria in plaque will ferment the sugars , releasing acids, reaching the enamel, the PH will decrease to 5.5, leading to demineralization. Calcium and phosphate are going out from hapetite

Dental caries is a bacterially based disease that progresses when acid produced by bacterial action on dietary fermentable carbohydrates , diffuses into the tooth and dissolves the mineral, that is, demineralization. Pathological factors including acidogenic bacteria (mutans streptococci and lactobacilli), salivary dysfunction, and dietary carbohydrates are related to caries progression. Protective factors which include salivary calcium, phosphate and proteins, salivary flow, and fluoride in saliva can balance, prevent or reverse dental caries.

Reminerlization→ minerals in the saliva will diffuse back sticking to tooth structure.

When fluoride diffuses back to the hydroxyappetite , it will form fluoro-appetite which is stronger and more acid resistant.

It's a benefit to have fluoride in the environment, because it sticks to enamel and makes it stronger.

The critical ph is 5.5, if it decreases demineralization will occur, it takes 2-5 minutes for the Ph to decrease, then the ph will gradually increase, remineralization will occur because of the buffer in the saliva and the washing effect it has.

The remineralization process is slower than demineralization, but why?

The ph went down quickly in the presence of sugar.

The plaque itself is a barrier to the removal of bacteria, it's going to limit the diffusion of saliva, that's why it's going to stay there for a while, the bacteria will continue to produce acid from polysaccharides, that's why it takes a longer time for the ph to go back to normal.

If a sugarry snack was taken every hour, it will lead to more decrease in the ph and the tooth will be subjected to more demineralization.

So the frequency of sugar intake should be reduced, so that the tooth won't be subjected to more acid production.

**The role of saliva:**

Decreased salivary flow or xerostomic patients; have a high caries risk.

The saliva has a washing effect that removes the bacteria or the produced acid from the mouth.

They tested the removal of major salivary glands in animals, and noticed that there was an increase in caries proportional to the reduced salivary flow.

Buffers are found in saliva; which is basically bicarbonates (has a role in neutralizing the acidity).

With high buffering capacity; caries are reduced.

Down syndrome patients are believed to have a normal salivary flow, it was believed that they have low risk to caries , but now they found that they have normal risk.

**Tooth susceptibility:**

There are teeth more susceptible to caries than others.

1-Depending on enamel composition:

If it has fluoride in enamel then it's more resistant to caries.

2- Enamel structure:

a- Hypomineralized enamel; it affects the rate of caries progression which will be faster.

b- Deep and narrow fissures; are more susceptible to caries. That's why we have fissure sealants

**Diet:**

1- Carbohydrates are fermentable by the bacteria and it's easily metabolized.

Types of carbohydrates: glucose, sucrose, fructose, galactose, maltose, and lactose.

Sucrose is the one that is mostly responsible for caries, the others are less cariogenic..

1- In Alaska they found that they had a low sugar intake which resulted in a lower caries incidence.

2- In some islands :

This is an island where the inhabitants up to 1930's, lived on fish meat and vegetables with very little amount of sugar and the caries incidence was low, however after the adoption of the western diet and introduction of sugar to their diet the caries increased 8 times.

3- War time diet

During the world war there was a rationing of certain dietary substances and the sugar was one of these substances, they gave a certain amount of sugar and noticed that during the war there was a decline in dental caries because of the controlled amount of sugar, after the war they had sugar as much as they wanted, and the caries incidence increased.

**\*\* Hereditary fructose intolerance:**

These people are unable to metabolize fructose noticing that these patients had a low incidence of caries.

**As a conclusion** :

 sugar is very important factor

Caries damage the tooth due to acid production from bacteria.

Dental caries are multifactorial , and their prevention isn't easy.

We're talking about balance, what we're trying to do is to increase the factors that promote remineralization and decrease those that promote demineralization.

If the environment favors demineralization → then caries will increase.

If the environment favors remineralization→ then it will stop the caries.