Dental Caries Prevention

**Aims:** To provide information on the cause of caries and the principles behind caries prevention.

**Objectives:** You will have a general understanding of the cause of dental caries and the principles behind caries prevention which will inform your professional practice.

**Introduction**

Tooth decay, known technically as dental caries, is an infectious and transmissible disease which is caused by certain types of acid-producing bacteria. These bacteria cause damage in the presence of fermentable carbohydrates which include sucrose, fructose and glucose. When the fermentable carbohydrates are broken down by the bacteria in dental plaque, lactic acid is produced. The resulting high levels of acidity from lactic acid in the mouth affect teeth because a tooth's mineral content causes it to be sensitive to low pH. This may lead to the acid dissolution of enamel and may eventually lead to the breakdown of the more organic dental tissues. The bacteria implemented in dental caries are Streptococcus mutans, Streptococcus sorrinus, and Lactobacillus species.

Specifically, a tooth is in a constant state of back-and-forth demineralisation and remineralisation between the tooth and surrounding saliva. When the PH at the surface of the tooth drops below 5.5, demineralisation starts to occur. If the acid attacks on the teeth are of short duration and frequency, saliva can aid in buffering the acids and replacing minerals and fluoride lost and assisting in remineralisation. If the acid attacks are frequent, prolonged, bacteria levels high, or if a patient suffers from reduced saliva flow, the balance is tipped in favour of demineralisation which eventually leads to a carious lesion developing. If left untreated, a decayed tooth can lead to pain, infection and possible tooth loss.

The latest figures from the Adult Dental Health Survey show that more adults than ever before are keeping their teeth for life- although many still suffer from dental caries. The oral health of children has also improved, with far fewer children suffering from tooth decay than they did 30 years ago. Older children in England now enjoy the best oral health in England.

As dental caries is a preventable disease it should be the objective of the dental team to offer appropriate prevention and education to keep patients free of decay. If children are appropriately educated and preventative treatment is offered they have the potential to stay caries free and have lifelong gain which may be passed down to future generations.
The principles of caries prevention

Dr Paul H Keyes observed that for the development of dental caries, three related components first had to be present. These are:

- A fermentable carbohydrate which provides the food source and matrix for the plaque.
- An oral flora in the form of Dental Plaque
- A susceptible tooth surface

Another factor that can be added to the three components is time. Although national surveys demonstrate a decline in the incidence of dental caries, they also highlight that there are inequalities which are strongly associated with social background. Levels of decay are higher in areas of material and social deprivation where people may have diets high in sugar and have poorer oral hygiene. In addition to this, inequalities may exist in the elderly, special needs and ethnic minorities. Identifying those patients that may be considered to be at risk from developing dental caries is important when providing preventative care to patients.

Prevention of dental caries revolves around removing, modifying or improving one of the above aetiological factors. Prevention of dental caries may require:

- Dietary Advice
- Effective plaque control
- Modification or improvement of the tooth structure through fluoride and fissure sealants.
Diet

Despite the fact that the misuse of sugar is known to be harmful, and has a possible role in obesity as well as dental caries, it still forms a considerable part of the diet of people in the UK. The majority of the English population consume more than the recommended maximum of 60g per day. The intake of fermentable carbohydrates should be reduced, modified or substituted as the greatest production of acid occurs when fermentable carbohydrates are ingested. When this happens the pH of the oral cavity drops in a matter of minutes, and can take up to 35-40 minutes to return to its original value. Therefore, repeated saccharolytic events will cause the pH to be constantly low and the teeth under attack for longer periods of time.

The Stephan Curve shows the change in the pH of dental plaque in response to a 10% sucrose solution. A rapid drop in pH is recorded followed by a slow rise until the pH returns to the normal resting value. The pH recovery is affected by the saliva flow rate as shown in Figure 1. This means that patients suffering from xerostomia (dry mouth) are more susceptible to dental caries.

![Figure 1. Stephan Curve: Effect of Saliva](image)

When attempting to reduce caries, the individual diet should be examined and this is best achieved through dietary analysis through the use of a diet sheet. The best way of doing this is through a 3-7 day written record. Patients are asked to write down everything they eat and drink in the specified time, any medication the patient is taking should also be entered.
Analysis of the Dietary Record

Initially all items on the diet sheet that contain sugar should be underlined in red. It is then possible to work out how many separate sugar intakes (sacchrololytic events) there are in each day.

This number should be recorded as it will be used to explain the importance of frequency of sugar intake to the patient before specific recommendations are made. Sometimes the patient may be asked to do this as this indicates whether the patient knows where the hidden sucrose is to be found.

Special note is taken of the following;

- The main meals- To see whether they are sufficiently substantial in order to prevent the patient craving snacks between meals
- The between meal snacks- Are they cariogenic
- The between meal drinks- Are they cariogenic
- Consistency of between meal snacks- Are they sticky and therefore take longer to clear from the mouth
- Sweets- If these are sucked it can take a long time to clear them from the mouth
- Any medication- Is it based on a sucrose syrup or is it likely to cause a dry mouth or thirst
- Sugary pre-bed snacks or drinks

Dietary Advice

- Dietary advice should be reasonable, practical and tailored to the individual needs of the patient. It is impossible to expect a patient to completely cut out sugar from their diet, but it is feasible to reduce the total amount of sugar consumed, and to restrict sugar intake mainly to mealtimes.

- It is very difficult to draw up a list of snacks that are safe in all respects for example cheese is safe for the teeth but is high in saturated fat. Cheese and nuts have been shown to raise plaque pH and so are useful as ‘safe snacks’ or as the last course of a meal. Fruit is less cariogenic than sweets but still contains natural sugar. Dried fruits such as raisins and apricots have high sugar content and many fruits are very acidic which can cause dental erosion if consumed frequently. Some raw vegetables such as carrots and tomatoes are ‘safe’. It should be advised that water should be drunk between meals.

- Sweeteners could be used as a sugar substitute. Sometimes a patient may think that they are doing the right thing by reducing the sugar in their tea or coffee to one spoon rather than two, but the frequency of sugar intake and therefore frequency of the pH fall is not altered. The patient must understand the important message that it is the frequency of sugar intake that needs to be reduced.
• Children should be advised to eat a balanced meal before any sweets are given, and sweets should be restricted as much as possible. They should be advised that if they are to eat sweets they also should be eaten all in one go rather than eaten throughout the day.

• Patients with xerostomia (dry mouth) are particularly at risk from dental caries due to them losing the buffering action of saliva. They should be encouraged to use saliva substitutes and drink plenty of water. Sugar free chewing gum is also helpful in stimulating saliva and neutralising plaque acids.

• Dental caries is infectious in that it is possible to pass on the bacteria such as Streptococcus mutans that have a role in the development of caries. In this way adults should be advised not to share utensils with their children. 7

• Xylitol has been found to be anti-cariogenic because the oral bacteria lack the enzymes to ferment it and it may inhibit the growth of streptococcus mutans. In effect the xylitol prevents the bacteria in plaque from recognising a cariogenic substance. 8 Sugar free chewing gums containing xylitol can be recommended.

• Pregnant or nursing mothers should be advised to breast feed their baby both because of the antibodies present in the milk, and from a cariogenic point of view as well because breast milk contains lactose which is significantly less cariogenic than sucrose. They should be advised not to add sugar to baby foods as this may lead to the development of a ‘sweet tooth’. They should be advised never to give a dummy or a bottle containing sweet sugar solution, or sugary drinks at night.

Plaque Control

The breakdown of refined carbohydrates by saccharolytic bacteria in plaque results in the metabolite lactic acid, which causes demineralisation of the tooth structure. The patient, therefore, needs to be taught a good basic tooth brushing technique and be instructed in the use of interdental cleaning aids such as floss, interdental brushes. The use of disclosing tablets can be recommended to highlight areas of plaque missed with the toothbrush or interdental aids.
Modifying the tooth structure

Fissure Sealants

The first permanent molars benefit most from fissure sealants. The sealant is a protective plastic coating, which fills the pits and fissures of the biting surface providing a shield and making them more resistant to caries.

Fissure Sealant

Fluoride

Since the 1970’s fluoride has been added to toothpaste and this has been cited as the main reason for the improvement in oral health in the UK and Europe. When fluoride is incorporated into the developing tooth structure, it increases the strength of the enamel by making it more resistant to dissolution by low pH. It may also modify the shape of the tooth, making it rounder with shallower pits and fissures. It is more effective on the smooth surface of the tooth and is important in the remineralising process, tipping the balance in favour of remineralisation of the early enamel lesion.

Fluoride can be administered systemically in the form of water fluoridation, drops or tablets or applied topically in the form of toothpastes, mouth rinses, APF fluoride gel or sodium fluoride varnish.

Healthy tooth  Early caries lesion  Carious tooth
Portfolio Tip

When filling in your verifiable chart consider how you will now change your practice as a result of reading this article. Do you understand the cause of decay and the principles behind caries prevention?

Non-verifiable CPD Tip

Consider further reading you may wish to do as a result of reading this article. We recommend that you read the Department of Health publication-Choosing Better Oral Health and also the Department of Health publication-Delivering Better Oral Health. An evidence-based toolkit for prevention. This publication will also form the basis of a future verifiable CPD article. These articles can be located by following the links from the non-verifiable CPD section.

Now take the exam and test your knowledge!

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