# **Rural ECOH Oral Health Training**

## DENTAL TERMINOLOGY AND ANATOMY

**Enamel** – enamel is the outer layer of the tooth. It is the hardest substance in the human body, however it is brittle. It is insensitive to hot, cold or sweet substances.

**Dentine**- is the second layer in a tooth and constitutes for the main bulk of the tooth. It is softer than enamel but is harder than bone. It is a light yellow in colour and is sensitive to hot, cold and sweet substances.

**Pulp-** is in the centre of tooth. This is the soft living tissue of the tooth. The pulp consists of blood vessels and nerves.

**Periodontium**- is the term used to refer to all of the tissues that surround and support the teeth to stay in the mouth. The tissues are periodontal ligament, cementum, alveolar bone and gingivae (gums).

- **Periodontal ligament-** is connective tissue, which holds the tooth in place in the alveolar bone. This ligament is flexible and acts as a shock absorber for the tooth. As teeth need to move slightly in order to withstand the pressures of chewing.
- **Cementum** covers the root of the tooth and provides attachment for the periodontal ligament.
- Alveolar bone- they are horseshoe-shaped bones which surround the root of the tooth.
- **Gingivae (gums)** soft tissues that cover the alveolar bone. There are different types depending on the structure and how attached it is to the tooth.



#### Figure 1. Parts of the tooth

Deciduous (primary) dentition consists of 20 teeth, which shed during childhood. These teeth erupt into the mouth between the ages of 6 months to 2 years. Figure 2 below outlines the approximate eruption dates. It is important to note that these eruption dates are only an approximate and vary considerably in children.

SVVZ	Upper Teeth — Central incisor — Lateral incisor — Canine (cuspid)	Erupt 8-12 mos. 9-13 mos. 16-22 mos.	<b>Shed</b> 6-7 yrs. 7-8 yrs. 10-12 yrs.
$\langle z \rangle \qquad \langle \star \rangle$	— First molar	13-19 mos.	9-11 yrs.
	<ul> <li>Second molar</li> </ul>	25-33 mos.	10-12 yrs.
		-	
	Lower Teeth	Erupt	Shed
	Lower Teeth — Second molar	Erupt 23–31 mos.	Shed 10-12 yrs.
	– Second molar – First molar	Erupt 23-31 mos. 14-18 mos.	<b>Shed</b> 10-12 yrs. 9-11 yrs.
	Lower Teeth     Second molar     First molar     Canine (cuspid)	Erupt 23-31 mos. 14-18 mos. 17-23 mos.	Shed 10-12 yrs. 9-11 yrs. 9-12 yrs.
	<ul> <li>Lower Teeth</li> <li>Second molar</li> <li>First molar</li> <li>Canine (cuspid)</li> <li>Lateral incisor</li> </ul>	Erupt 23-31 mos. 14-18 mos. 17-23 mos. 10-16 mos.	Shed 10-12 yrs. 9-11 yrs. 9-12 yrs. 7-8 yrs.

#### Figure 2. Decidous teeth eruption times

Permanent (secondary) dentition consists of 32 teeth. Figure 3 below outlines the approximate eruption dates. It is important to note that these eruption dates are only an approximate and vary considerably in children and adolescents.



Figure 3. Permanent teeth eruption times













## DENTAL DISEASES (WHAT ARE THEY, WHAT CAUSES THEM, RISK FACTORS)

#### Dental caries (tooth decay)

#### What is it?

Dental caries is an infectious and chronic condition and is the progressive breakdown of enamel, dentine due to a number of factors (discussed in detail within the next section). It affects all ages and it is estimated that over 95% of the worlds population either has active caries or has had a carious lesion. Dental caries is five times more likely to occur in children than asthma and hay fever. It is a preventable condition.

Dental caries can cause pain, discomfort and affect eating, speaking and sleeping, depending on the stage of caries. Below outlines the stages of caries and associated symptoms;

- Dental caries in the enamel is painless,
- Caries in the dentine may be associated with pain on exposure to heat, cold or sweet substances,
- Caries that progresses into the pulp can cause severe spontaneous or persistent pain and if left untreated often leads to an abscess.



#### TOOTH DECAY

Figure 4. Stages of dental caries













#### What causes it?

Dental caries is caused by multiple factors. For caries to develop the following three factors must be present at the same time;

- 1. A susceptible tooth
- 2. Micro-organisms (specific bacteria)
- 3. A diet rich in fermentable carbohydrates

Without the presence of all three factors caries will not develop. Other influencing factors are time and saliva.



Figure 5. Dental caries process

**Bacteria** are present in the plaque. Plaque is the soft mass of bacterial deposits that covers tooth surfaces (the furry feeling). Plaque continually builds up on the teeth and if not removed will appear as a sticky white material.

The bacteria (only specific types) in the plaque feed on **fermentable carbohydrates**, such as sugars (including fruit sugars) and cooked starch found in a person's diet. The bacteria produce acid as a by-product of digesting the carbohydrates. It takes about 5 minutes after eating for the bacteria to produce acid.

The acid in the mouth causes the pH in the mouth to drop; once the pH of the mouth is below 5.5 an acid attack occurs. During an acid attack, acids can penetrate into a tooth and dissolve some of the minerals in the tooth (calcium and phosphate). This is known as demineralisation.

The **saliva** can help to help repair the damage by neutralising acid (buffering effect) and by supplying fluoride, phosphate and calcium to replace those lost from the tooth. This is called remineralisation. It takes about 30 minutes to 1 hour for this process of remineralisation to occur. Figure 6 demonstrates the process of demineralisation and remineralisation.













Dental caries occurs when the episodes of demineralisation outweighs the episodes of remineralisations. That is when the amount of minerals being lost out of a tooth outweighs the minerals being deposited back in (time).



- 1. The tooth is attacked by acids in plaque and saliva.
- Calcium and phosphate dissolve from the enamel in the process of demineralization.
- 3. Fluoride, phosphate, and calcium re-enter the enamel in a process called remineralization.

Figure 6. Demineralisation and remineralisation of the tooth

#### **Risk factors for caries**

There are a range of factors that place a person at higher risk of developing dental caries. These are bacteria levels, a diet high in sugar and carbohydrates, constant snacking and reduced salvia flow. These factors will be discussed below further.

#### Bacteria

Children are not born with the main bacterium that causes dental caries (*Mutans streptococci*). This bacterium is introduced into the mouth normally from a primary caregiver. The bacteria are normally transferred via salvia. For example, by 'cleaning' a dummy in the mouth and then giving it to the child. The risk of passing the bacteria to babies is greater if the caregiver has dental caries that is not treated, so it is important that caregivers also look after their own oral health.

#### Diet

Research has found that people who have a diet high in sugar and fermentable carbohydrates have increased prevalence of dental caries. A major factor in determining how decay promoting a carbohydrate is how long the food stays in the mouth. Sugary liquids, which leave the mouth more quickly, are not as decay promoting as sticky food such as caramels or raisins. However, the frequency of exposure to these foods is more important than the amount of the food which is consumed.













#### Constant snacking (acid attacks)

The other aspect of diet, which increases a person chance of developing dental caries, is the frequency of eating fermentable carbohydrates. This is because a person is greatly increasing the amount of acid attacks that are occurring in their mouth. As previously mentioned when a person eats fermentable carbohydrates or sugar the bacteria produce acid which means the pH in mouth drops. If the pH in the mouth drops below 5.5 (critical level) demineralisation of the teeth start to occur this is demonstrated by the Stephan curve (figure 7). The longer the mouth stays in the danger zone the more minerals are lost from the tooth and the higher a person's chances are developing dental caries.

The Stephan curve is a graph used to demonstrate how quickly the pH falls in the mouth after eating and how long it takes to return to normal (at least 30 minutes).



Figure 7. Stephan curve

This process of the pH dropping and then buffering back up to neutral occurs a majority of the time when you eat. Below is a diagram of a Stephen curve for a person who does not regularly snack. After eating all meals and snacks the pH of the mouth drops below the critical point, but has time to neutralise and spends more time in the safe zone (where remineralisation can occur) than the danger zone.















A Healthy Stephan Curve

Figure 8. A healthy Stephan curve

Compare this to a person who has the same five meals, but then also has three coffees a day with added sugar or soft drink or a person who snacks on lollies. The Stephan curve below (figure 9) demonstrates how much more time is spent in the danger zone when demineralisation of the teeth is occurring.





Figure 9. A less healthy Stephan curve

It is important to note that nearly every time a person eats something, the pH drops below the critical point of 5.5 and takes 30-40 minutes for their saliva to get you back to the safe zone. The longer a person snacks for, the longer they are at risk and the longer it takes for their mouth to recover. Also if a person has something else sugary to eat (constant snacking) before the saliva has done its job, the curve heads straight back down into the danger zone and their teeth continue to demineralise.













#### **Reduced saliva flow**

Salvia is a protective measure against dental caries as it cleanses the teeth and also contains calcium, phosphate and fluoride which helps with remineralisation. Dental caries risk increases if a person has reduced saliva flow. There a range a factors that can cause a reduction in salvia flow, such as certain medications, illnesses and radiation therapy.

The more of these risk factors that are present in a person the higher their chances are of developing dental caries. There are a range of factors which have a protecting function. However, if the risk factors outweigh the protecting factors a cavity will form (figure 10).



Figure 10. Risk factors and protecting factors

#### Early childhood caries

Early Childhood Caries (ECC) is a severe form of dental caries that affects the deciduous teeth of infants and young children. It affects mainly the upper front teeth and upper and lower molars. It is less commonly seen on the canines (eye teeth) and lower front teeth.

The pattern of caries is associated with long periods of exposure to substances with sugar in them, especially bottles with fermentable carbohydrates (even milk). If a child sleeps with a bottle the chance of developing early childhood caries is increased. This is due to the milk pooling over the teeth (especially the front) while the child sleeps. Combine this with low salivary flow at night which reduces a buffering affect. Also if parents have untreated dental













caries this also increases a child's chance of developing ECC. As the bacteria that causes ECC can be passed from caregiver to child.

If ECC is detected in the early stages of development, the damage can be reversed. However, children with advanced ECC need significant dental treatment and may require hospitalisation to have the treatment completed.



Figure 11. Stages of Early Childhood Caries













#### **Periodontal disease**

Periodontal disease is an infectious disease that involves inflammation of the tissues of the periodontium. There are two main types of periodontal disease, gingivitis and periodontitis. Periodontal disease can lead to tooth loss.

#### **Gingivitis**

Gingivitis is the inflammation of the gingival tissue. It is characterised of areas of redness, swelling and the gingiva tends to bleed easily.

Gingivitis is normally painless and is often unrecognised until a dental health professional emphasises its importance. Gingivitis is reversible with improved oral hygiene practices. It is said to affect about 40% of the world's population and can affect children.

#### What causes it?

The primary cause of gingivitis is build-up of plaque. However, type of bacteria, length of time bacteria is left undisturbed and patient's response to bacteria are also factors in development of gingivitis. Bacteria in dental plaque cause inflammation by producing enzymes and toxins that destroy periodontal tissues and lower hosts defenses.

Secondary causes of gingivitis include hormone changes during pregnancy, puberty and menopause. It can also be cause by certain drugs such as beta blockers (used for high blood pressure) and a type of drug that is used for epilepsy (phenytoin).



Figure 12. Diagram of gingivitis













#### Periodontitis

Periodontitis is the inflammation of the supporting tissues of the teeth (periodontium). The inflammation starts in the gingiva and then progresses into the connective tissue (periodontal ligament) and then into the alveolar bone. This continual inflammation leads to the gradual destruction of the supporting tissues. The gingiva detaches from the tooth the periodontal ligament and alveolar bone is damaged and an abnormal gap (pocket) develops between the tooth and gingiva. The tooth will loosen and may eventually be lost. This destruction is largely irreversible.

It is thought to affect about 95% of the adult population at some stage of their life, but only about 10-15% of people will lose teeth due to the disease.

Signs of periodontal disease include;

- Bleeding, swelling and receding gums,
- Bad breath,
- A bad taste in the mouth and,
- Loose teeth.



Figure 13. Diagram of common characteristics of periodontal disease compared to the healthy state













#### What causes it?

Dental plaque plays a major role in the development of periodontitis, like gingivitis there are other factors which predispose a person to plaque accumulation or which modifies the host response. Periodontitis may be the result of gingivitis.

If plaque is left too long on the tooth, it can be mineralised which results in the formation of calculus (tartar). Calculus is hard and attached to the tooth surface. The surface of calculus is porous and rough, which provides a perfect surface for more plaque accumulation. Calculus can form on the tooth surface and also on the root of the tooth (under the gingiva). Calculus itself is not a cause of periodontal disease, but it is always covered by plaque and retains the toxins produced by the bacteria. Calculus cannot be removed by tooth brushing; it needs to be removed by a dental professional.

#### Factors that increase the risk of periodontal disease

A number of factors can increase a person's risk of developing periodontitis. One is factors which increase the plaque accumulation on the teeth and the other factors modify the inflammatory response of the host.

Crowded, crooked or rotated teeth and rough areas on the teeth or orthodontic appliances enhance local accumulation and retention of plaque. Therefore increasing a person's risk of developing periodontal disease.

Smoking and diabetes are two risk factors, which affect the host response to local irritants increasing the severity of periodontitis. Smokers have greater loss of attachment, calculus formation and tooth loss. Also periodontal treatment is less effective in smokers. People with diabetes, which is not under control, have more attachment and bone loss, than people who have controlled diabetes. The relationship of diabetes and periodontal disease is a two way process, as periodontal disease increases the resistance to insulin. Therefore it is very important for people with diabetes to have regular check-ups and treatment of periodontal disease.













#### **Oral Cancer**

Oral cancer can affect all the soft tissues in the mouth and salivary glands, but is most commonly found in the tongue, floor of the mouth, lips and cheeks. Mortality rates for oral cancer is high, not because it is hard to diagnose but because it is asymptomatic and diagnosed at a late stage. Early detection of oral cancer improves survival chances.

SITE OF CANCER	INCIDENCE (No.)	MORTALITY (No.)
Lip	786	10
Tongue	479	148
Mouth	500	110
Major salivary glands	258	81
Oropharynx	334	117
TOTAL	2357	466

Table 1. Incidence and mortality of oral cancer by site, Australia 2005

#### **Risk factors for oral cancer**

The following risk factors increase a person's chance of developing oral cancer.

- **Tobacco smoking** smoking cigarettes or pipes, using chewing tobacco and dipping snuff causes about 85% of head and neck cancers.
- Excessive alcohol consumption- the risk of oral cancer increases with the number of drinks per day and the number of years of drinking alcohol. The combination of heavy smoking and heavy alcohol use increases the risk.
- **Sunlight exposure** this is especially important for lower lip cancer. Lip cancer is more common among rural workers than urban workers.
- **Age** cancer of the oral cavity is rare in people less than 40 years of age and the same risk factors may not apply to those in the younger category.
- Viral infections including human papilloma virus- the role of viruses in the development of cancer of the oral mucosa has been given attention, and in particular human papilloma virus (HPV). Human papilloma virus types 16 and 18 are found in 22% and 14% of oropharyngeal tumours, respectively, and they increase the risk of cancer development by three- to- five-fold. There is also an association between oral cancer and sexual activity. Women who have ever had oral sex have four times the risk of cancer of the base of the tongue than women who have not, and having two sexual partners in comparison with only one doubles the risk. Among men a history of same-sex sexual contact increases the risk by almost nine-fold.













#### Symptoms of oral cancer

Pre-cancerous and early cancerous lesions are usually subtle and asymptomatic. However, signs of oral cancer can include the following;

- A visible mass or lump that may or may not be painful,
- An ulcer that will not heal (anything past 2 weeks),
- A persistent blood blister,
- Bleeding from the mass or ulcer,
- Loss of sensation anywhere in the mouth,
- Trouble swallowing,
- Impaired tongue mobility,
- Difficulty moving the jaw,
- Speech changes, such as slurring or lack of clarity,
- Loose teeth and/or sore gums,
- Altered taste,
- Swollen lymph glands.













# **PREVENTION STRATEGIES**

General advice to prevent dental caries and periodontal disease should centre on the following areas; eating a healthy diet, daily tooth brushing, drinking tap water, regular dental check-ups, quit smoking, interdental cleaning, chew gum between meals and taking extra precautions if taking medication that causes dry mouth.

#### Eating a healthy diet

Dental caries cannot occur without dietary sugars, therefore it is important to eat a healthy diet to reduce the risk of developing dental caries. It is encouraged that people follow the Australian dietary guidelines and limit sugary foods and drinks and choose healthy snacks (fruits and vegetables).

Specific advice to reduce the risk of developing caries would be:

- Avoid sugary snacks between meals (as snacking between meals increases acid attacks)
- If a person is to eat sugary foods or drinks, group these with meals particularly sugary drinks. This goes back to the Stephan curve where pH in the mouth drops when eating regardless of the amount of sugar and fermentable carbohydrates consumed.
- Avoid sipping sugary drinks over many hours such as a bottle of coke (increases acid attacks)
- Keep sugar clear of night time- nothing sugary before bed and nothing sugary during the night. At night a person's saliva flow rate drops. Saliva is your natural protection so anything left in your mouth during this time does a lot more damage.
- Be aware of the consistency of the food. It has been shown that it is much more difficult to clear sticky foods from in and around your teeth. An example is toffees which take some serious chewing and get wedged in the tops of teeth for some time afterwards. Saliva cannot wash this away, in the same way it could, for example, a glass of lemonade. While the food remains, it provides sustenance for the bacterial plaque; prolonging the release of acid into a person's mouth.
- Be wary of food that is labelled 'no added sugar', this may still contain high amounts of natural sugar (found in fruit) and can still have the same effect as other types of sugar.

#### Toothbrushing

The two main aims of toothbrushing, to prevent dental disease, is to remove or disrupt plaque build-up and to introduce fluoride into the oral cavity.

It has been demonstrated that brushing twice daily with fluoride toothpaste is effective in reducing caries. It is recommended that people brush with a soft small head toothbrush along the gum line. This should occur twice a day and brushing for 2 minutes is recommended. Toothbrushing technique is provided in figure 14. The most important time of the day for brushing to occur is night time before bed. This is due to saliva flow rate dropping at night.

Toothbrushing should start as soon as the first tooth erupts into a child's mouth (around 6 months). Baby or infant toothbrushes can be used, other options to clean babies' teeth are a face washer or finger brushes. Children younger than 8 years of age generally do not have













the manually dexterity to thoroughly clean all surfaces of their teeth. They will require assistance from an adult.

It is recommended that people over the age should 18 months should use an age appropriate fluoride toothpaste. Children between the ages of 18 months and 6 years should use a low fluoride toothpaste (children toothpaste). Standard fluoride toothpaste can be used from 6 years onward as long as the child is spitting the excess toothpaste out. After brushing, excess toothpaste should be spat out, but mouth should <u>not</u> be rinsed with water. As rinsing with water dilutes the fluoride in the salvia. Fluoride in salvia is needed to assist with the remineralisation process.



1. Place bristles along the gumline at a 45° angle. Bristles should contact both the tooth surface and the gumline.



2. Gently brush the outer tooth surfaces of 2-3 teeth using a vibrating back, forth & rolling motion. Move brush to the next group of 2-3 teeth and repeat.



3. Maintain a 45° angle with bristles contacting the tooth surface and gumline. Gently brush using back, forth & rolling motion along all of the inner tooth surfaces.



4. Tilt brush vertically behind the front teeth. Make several up & down strokes using the front half of the brush.



5. Place the brush against the biting surface of the teeth & use a gentle back & forth scrubbing motion. Brush the tongue from back to front to remove odor-producing bacteria.

Figure 14. Toothbrushing technique













#### **Interdental cleaning**

When used properly floss can remove plaque from in between the teeth and reduce a person's risk of developing gingivitis. There are other forms of interdental cleaning products that can be recommended on the advice of a dental professional.

Flossing technique (figure 15)

- Use enough floss so that you can wrap it around your middle fingers. Use your thumbs and index fingers to guide the floss.
- Gently ease the floss between two teeth and form a 'C' shape against the surface of one tooth.
- Pull the floss so that it is tight around the tooth.
- Gently guide it up and down from the chewing surface to under the gum.
- Repeat for all teeth. Don't forget to floss the back of your last teeth.





Figure 15. Flossing technique













#### Drink tap water

Healthy drinks are important for overall health and oral health. It is recommended that people drink plenty of tap water (especially if it is fluoridated). Fluoride is found in most tap water in Victoria, it helps to repair the damage caused by acid attacks. Other drinks that can be drank on a daily basis is plain milk (or soy milk with calcium).

It is recommended to restrict the following drinks to sometimes drinks as they are high in sugar. Below is a visual representation of amount of sugar in some popular sugary drinks (figure 16).

- All fruit juices and fruit drinks (contain about the same amount of sugar as a fizzy drink)
- Soft drinks (including diet varieties)
- Cordials
- Sports drinks
- Fizzy (carbonated) drinks
- Energy drinks
- Flavoured water and flavoured ice teas
- Flavoured milk and yoghurt drinks.



Figure 16. Amount of sugar in popular drinks













#### **Regular dental check-ups**

Regular oral health check-ups are important for oral health. In Australia it is recommended that children should have an oral health assessment by the age of 2. The frequency of how often a person should have an oral health check-up is based on risk and oral health needs. An oral health professional will advise you on how often to visit for a preventive check-up.

#### **Quit smoking**

Smoking results in more disease and injury than any other single risk factor. Smoking is a risk factor for periodontal disease and oral cancer. It is recommend that people quit smoking to improve oral and general health. People can discuss quitting with a doctor, oral health professional or any other allied health professional.

#### Chew gum between meals

There is good evidence to support the use of sugar-free chewing gum as a decay preventive measure. Chewing sugar free gum has been shown to be beneficial for a number of reasons. When people chew sugar free gum salivary production is stimulated and a great volume of salvia is produced. The higher rates of saliva provides a faster clearance of fermentable carbohydrates and food particles in the mouth. These higher rates also dilute the acid in the mouth, which buffers the pH in the mouth to neutral in a shorter time. This is demonstrated in figure X. The graph shows the difference in time that the pH level is below critical for someone who chews gum after a meal compared to someone who does not.



Figure 17. Difference in mouth pHchewing sugar free gum and not.

#### Medications that cause dry mouth

There are around 400 types of medication that can cause dry mouth. The main types of medication that causes dry mouth are antihistamines, antidepressants, anticholinergics, anorexiants, antihypertensives, antipsychotics, anti-Parkinson agents, diuretics and sedatives.

If a person has dry mouth the following advice should be given to reduce their chances of developing dental caries or periodontal disease.

- Increase their water intake
- Restrict sweet food and drinks
- Refer to a dental professional for regular check-ups
- Salvia substitutes are available, but need to be prescribed by a dentist or a doctor
- There are specific dry mouth dental products that can be used (this includes toothpaste, mouthwash and topical gels)













#### Further resources

- Dental Health Services Victoria <a href="https://www.dhsv.org.au/">https://www.dhsv.org.au/</a>
- Department of Health and Human Services Oral Health Promotion Evidence Review
   <u>http://www.health.vic.gov.au/search.htm?q=oral+health+promotion</u>
- Rural ECOH http://ruralecoh.com/

#### Resources used to develop these course notes

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