Links between oral health and general health
the case for action
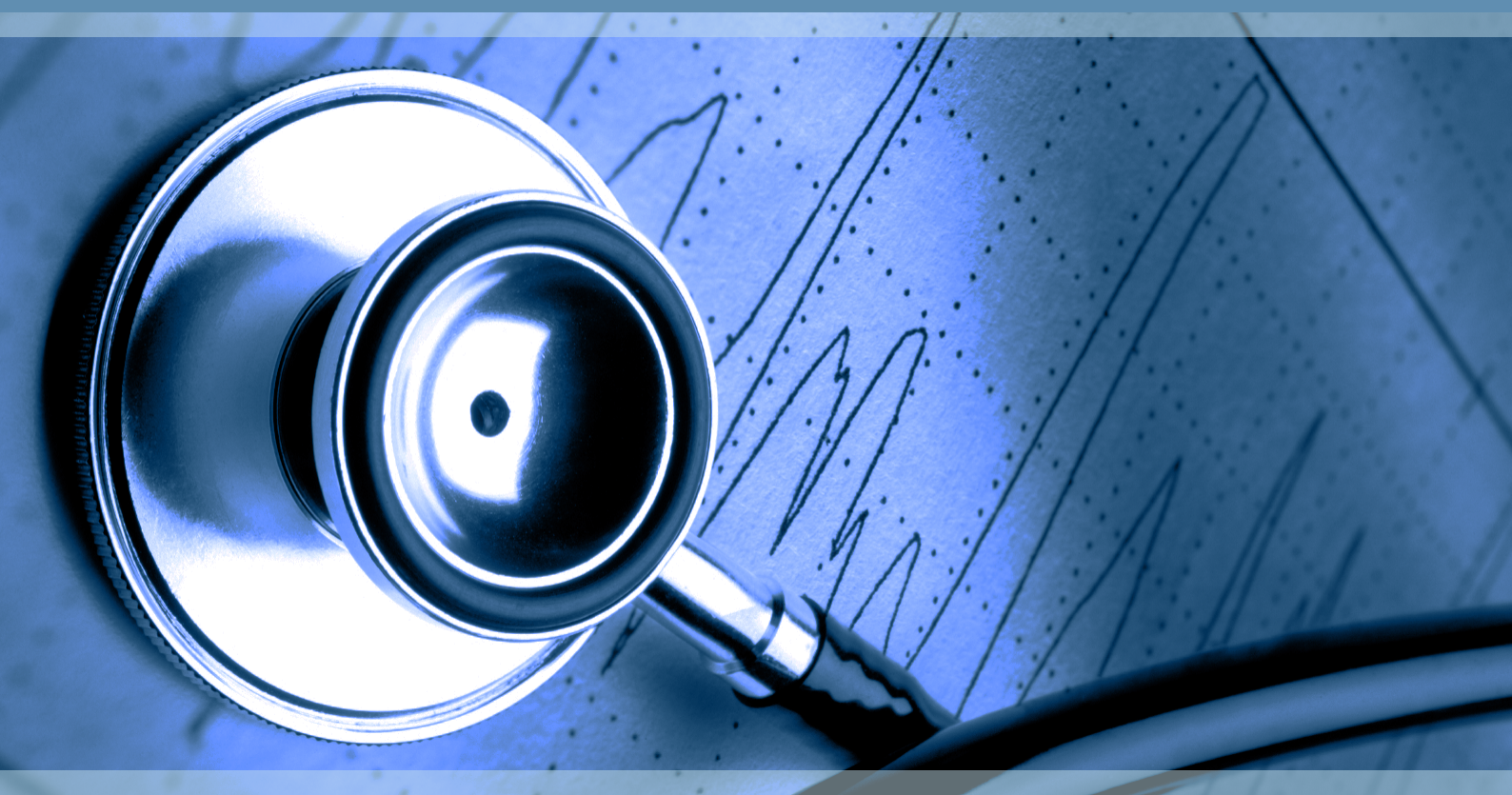
dental health
services victoria

oral health for **better health**

Dental decay is the second most costly diet-related disease in Australia, with an economic impact comparable with heart disease and diabetes. Approximately $6.1 billion was spent on dental services in 2007-08, representing 6.2%[1] of total health expenditure. Despite this effort, decay and periodontal diseases remain a major health problem. Oral health can no longer be ignored in designing overall national health strategies. It is essential to protect natural teeth from decay and periodontal disease, and focus on early detection and prevention of these conditions. Evidence clearly demonstrates that these diseases are not just limited to the mouth, but importantly are linked to general health overall.

Introduction

Two major conditions affect teeth – caries (decay) and periodontal disease.

Our mouths are full of bacteria. Germs in the mouth (bacteria) use the sugar in food to make acids. Over time, the acids can attack the tooth, creating decay leading to a cavity. These bacteria, along with mucus and other particles, constantly form a sticky, colourless film called "plaque" on teeth. Brushing and flossing help get rid of plaque. Plaque that is not removed can harden and form "tartar" that brushing doesn't clean. Only professional cleaning by a dental health professional can remove tartar.

The longer plaque and tartar are on teeth, the more harmful they become. Untreated decay can become so advanced that the tooth must be removed (extraction). The bacteria cause inflammation of the gums that is called "gingivitis." In gingivitis, the gums become red, swollen and can bleed easily. Gingivitis is a mild form of gum disease that can usually be reversed with daily brushing and flossing, and regular cleaning by a dental health professional. This form of gum disease does not include any loss of bone and tissue that hold teeth in place.

Untreated gum disease can advance to "periodontitis" (which means "inflammation around the tooth"). In periodontitis, gums pull away from the teeth and form spaces (called "pockets") that become infected. The body's immune system fights the bacteria as the infection spreads and grows below the gum line. Bacterial toxins and the

body's natural response to infection start to break down the bone and connective tissue that hold teeth in place. If not treated, the bones, gums, and tissue that support the teeth are destroyed. Otherwise functional teeth may eventually become loose and have to be removed. Overall, 70% of tooth loss is due to tooth decay, 20% due to periodontal diseases and 10% due to other causes[2,3]. Periodontal disease is one of the most common diseases and if untreated becomes a serious and destructive chronic infection.

However this is not the only problem. Oral health problems are also related to general health. This is an important connection in terms of preventing chronic disease and disability and reducing health care costs.

The *World Oral Health Report* (2003)[4] stated clearly that the relationship between oral health and general health is proven by evidence. Since that report, new evidence has emerged further strengthening the case. Oral health and general health are related in four major ways:

1. Poor oral health is significantly associated with major chronic diseases
2. Poor oral health causes disability
3. Oral health issues and major diseases share common risk factors
4. General health problems may cause or worsen oral health conditions.

1. Poor oral health is significantly associated with major chronic diseases

During the past 15 years, evidence from population-based studies increasingly points to a robust connection between oral health status and serious major chronic diseases.

Cardiovascular disease

Cardiovascular disease (CVD), affecting the heart and blood vessels, is a very common and serious disease in Australia with about 3.5 million people reporting having the condition in 2007-08. Despite significant advances in the treatment of CVD and for some of its risk factors, it remains the cause of more deaths than any other disease - about 50,000 in 2008 - and the most expensive, costing about $5.9 billion in 2004-05[5].

Studies reported about a decade ago demonstrated that both periodontal disease and total loss of teeth were associated with greater risk for cardiovascular disease[6,7,8]. In 2006, Holmlund et al investigated whether the severity of periodontal disease and number of remaining teeth related to a past history of heart attack and high blood pressure or hypertension (HT)[9]. Self-reported history of HT and heart attack was collected in 3,352 patients referred for periodontal diseases to a Swedish county hospital, and in 902 people randomly selected from the general population. Severity of patients' periodontal problems was estimated. The severity of periodontal disease was related to HT independent of age and to the prevalence[10] of heart attack (number of patients reporting that they had a past heart attack) in middle-aged subjects only. On the other hand, the number of teeth was associated with the prevalence of heart attack independent of age. This study showed that both periodontal disease and overall tooth loss from any cause are closely related to cardiovascular disease.

More recent evidence from an even larger study by the same authors[11], has found the alarming result that a person with fewer than 10 of their own teeth remaining is seven times more likely to die of coronary disease than someone with more than 25 of their own teeth. The severity of periodontal disease was not related to likelihood of death.

The authors concluded that this fairly large prospective study of 7,674 subjects with a long follow-up period (1976-2002) presents a linear relationship between number of teeth and death from CVD, indicating a direct link between oral health and CVD, and that the number of teeth can be used to assess increased risk of CVD in adults.

Alman et al (2011) have shown a significant positive association between loss of bone supporting teeth due to periodontal disease and CVD. This was found at even low levels of bone loss between 10% and 20%[12].

After conducting a systematic review in 2007 of studies examining the association between periodontal disease and CVD, Bahekar and colleagues concluded that the numbers of existing and new cases of coronary heart disease are both significantly increased in periodontal disease[13]. Khader et al (2004)[14] in a meta-analysis also reported similar relationships.

Diabetes

A new Korean study has identified a relationship between total tooth loss from any cause and diabetes[15]. Severe periodontal disease is also associated with diabetes. People with diabetes are more likely to have periodontal disease than people without diabetes, probably because diabetics are more susceptible to infection anywhere in the body. In fact, periodontal disease is often considered the 'sixth complication' of diabetes[16]. Poorly controlled diabetics are especially at risk because they are more likely to develop periodontal disease than well-controlled diabetics. Emerging evidence also suggests that periodontal disease predicts the development of end-stage kidney disease in diabetic patients[17].

Research has emerged however, that suggests that the relationship between periodontal disease and diabetes goes both ways – the presence of periodontal disease may make it more difficult for diabetics to control their blood sugar. Severe periodontal disease can increase blood sugar

levels. This puts diabetics at increased risk for diabetic complications.

A study conducted in 2006 showed that diabetic individuals with periodontal disease had worse long-term control of blood sugar (as measured by higher haemoglobin A1c levels (p=0.033)) and higher number had cardiovascular complications (p=0.012) than a comparison group with good oral health[18].

While there is an increasingly strong body of evidence that supports this damaging two-way relationship between periodontal diseases and diabetes, many patients and health care providers are unaware of this. A 2011 study of 232 physicians and 278 dentists showed that only 50% of all study participants believed that patients with diabetes were more susceptible to tooth loss because of periodontal diseases than were individuals without diabetes. Dentists were significantly more aware of signs of periodontal disease than were physicians. The authors concluded that dental and medical practitioners need to know more about the important association between periodontal diseases and diabetes - to effectively prevent, manage, and control diabetes and periodontal diseases[18]. This is especially significant when considering that dental problems consume substantial Medicare resources due to patients accessing subsidized consultations from non-dentally trained health care professionals. Britt et al. (1999) reported over half a million encounters with general practitioners for dental problems over 2 years of data collection from 1998 - 1999[20].

Communication with health care professionals requires a multifaceted approach that includes publication of research findings in medical and dental journals, cooperation among professional organizations and initiatives at the local level such as presentations at medical grand rounds[21]. Indeed, Taylor et al assert that with a relatively small but concerted effort, a large possible gain might be made in reducing the burden of diabetes on patients, families and society[22]. Due to the importance of the connection between oral health and diabetes, Li et al (2011)[23] have developed a clinical guideline to help dentists identify patients with undiagnosed diabetes, hoping to improve the early identification of diabetes and, thus, reduce morbidity and health care costs.

Respiratory diseases

Not only cardiovascular diseases and diabetes, but also cancer and respiratory (lung) disease are major causes of death in developed countries. Aida et al, 2011[24] in a report just published, have undertaken the first study to simultaneously compare the contribution of oral health with these major causes of death. This study examined the association between oral health and deaths from cardiovascular diseases, cancer, and respiratory problems among older Japanese. Self-administered questionnaires were mailed to participants in the Aichi Gerontological Evaluation Study (AGES) Project in 2003. Several years later, deaths were analysed for 4,425 respondents. Three categories of oral health were used: 20 or more teeth; 19 or fewer teeth and eat everything; 19 or fewer teeth and eating difficulty. Sex, age, body mass index (BMI), self-rated health, present illness, exercise, smoking, alcohol, education, and income were taken into account.

During 4.28 years' follow-up, 410 people had died; 159 from cancer, 108 from cardiovascular diseases, and 58 from respiratory disease. Statistical models of risk showed that, compared with the respondents with 20 or more teeth, respondents with 19 or fewer teeth and with eating difficulty had a 1.83 and 1.85 times higher hazard ratio for deaths from cardiovascular disease and respiratory disease, respectively. There was no significant association with cancer deaths. This study showed that oral health predicted cardiovascular and respiratory disease deaths but not cancer deaths in older Japanese.

A 2006 systematic review looked at the association between respiratory diseases and oral health[25]. There was good evidence that improved oral hygiene and frequent professional oral health care reduces the progression or occurrence of respiratory diseases among high-risk elderly adults living in nursing homes and especially those in intensive care units (ICUs). There was fair evidence that the risk of pneumonia was related to level of oral health. There was poor evidence but it did show a weak association between Chronic Obstructive Pulmonary Disease (COPD) and oral health. However, a subsequent study of the association between periodontitis in severe COPD patients and those with other severe respiratory diseases found that

the prevalence of periodontitis was 44% in the COPD group and 7.3% in the comparison group and this was significant after adjusting for age, gender and number of cigarettes smoked[26]. Further large-scale studies are justified.

Stroke

Cerebrovascular ischaemic strokes are the commonest kind of stroke and occur as a result of an obstruction, usually a clot, within a blood vessel supplying blood to the brain. The underlying condition is the development of fatty deposits lining the vessel walls, causing hardening of the arteries. After heart disease, stroke is the next most important consequence of hardening of the arteries. Stroke remains the third leading cause of death (after heart disease and cancer) in most developed countries.

Studies have found that poor dental health is associated with stroke. Beck and colleagues (1996)[27] did not separate haemorrhagic (bleeding) stroke from ischaemic stroke (clot) but observed a very strong association of periodontal disease with the incidence of stroke among US veterans (RR 2.8, CI 1.45-5.48). The veterans are known to have higher disease experience of stroke, but combining both causes of stroke might have underestimated the true impact of periodontal diseases[28].

Morrison et al. (1999)[29] observed a non-significant increase in risk of fatal stroke in patients with periodontal disease. Wu and colleagues (2000) examined the relationship between periodontal health status and fatal and non-fatal stroke. They found an approximately 17% increase in the risk for stroke among those with severe periodontal disease in comparison with healthy individuals[30].

Joshipura et al (2003)[31] also recently reported a significant association between stroke and periodontal disease and between stroke and number (n = 16) of remaining teeth. In their review, Janket et al (2003) observed the relationship between periodontal disease and stroke to be "much stronger than that between periodontal disease and CVD".

Dentists usually provide antibiotic cover to patients who have abnormal heart valves to prevent bacteria entering the blood during dental treatment and causing an infection of the valves called SBE (subacute bacterial endocarditis). However, poor dental hygiene and periodontal diseases may cause bacteria in the blood even in the absence of dental procedures. This risk is directly proportional to the degree of oral inflammation and infection[32].

Kidney diseases

Changes in the mouth, such as periodontal disease and other signs of poor oral health, are common in patients with chronic kidney disease (CKD) and may contribute to increased health complications and death rates because of consequences such as inflammation, infections, protein-energy wasting, and complications from hardening of the arteries. Poor oral health in CKD patients may thus represent an important, but often overlooked, problem. The consequences of poor oral health may be more severe in CKD patients because of advanced age, common existing additional diseases such as diabetes, concurrent medications, and a state of reduced immune function that may increase the risk for consequences of periodontitis and other oral and dental conditions. Poor condition of teeth and other signs of poor oral health should be an 'alarm clock' also at early stages of CKD. However, it remains to be determined whether and how more successful management of poor oral health and periodontitis will reduce the risk complications in CKD patients[33].

Peripheral vascular disease

Hardening of the arteries, for example in the legs, called peripheral vascular disease (PVD), may result in reduced blood flow. Meurman et al (2004)[34], in a recent review, have concluded that periodontal disease appears to increase the risk of PVD. However, this statement needs to be confirmed by further studies.

Dementia

Tooth loss from any cause has been reported to be associated with Alzheimer's disease and dementia[35,36,37]. A new study included more than 4,000 Japanese participants, aged 65 and older, who underwent a dental examination and a psychiatric assessment. Compared with participants who still had many of their natural teeth, those with fewer or no teeth were much more likely to have experienced some memory loss or have early-

stage Alzheimer's disease[38]. Impaired delayed memory and calculation has been shown to be associated with periodontal disease as shown by blood tests[39].

Adverse pregnancy outcomes

Premature birth rates have not reduced significantly despite advances in antenatal care and almost 50 per cent of mothers delivering preterm babies have none of the known risk factors such as smoking, alcohol consumption, previous low birthweight baby, stress, illness, low socio-economic status or poor nutrition. Infection, particularly maternal genito-urinary tract infection, is implicated in a large number of cases. However, researchers think that maternal infection and inflammation elsewhere may also play a role. Hence, infection with bacteria from periodontal disease in the mouth may affect the health of the pregnant uterus leading to low birth-weight and premature contractions of the uterus[40]. Babies born prematurely are at a significant risk of developing serious and lasting health problems, and have an increased risk of death. A landmark study in 1996 first showed a significant association between preterm birth and periodontal disease[41]. Pregnant women are hormonally more likely to develop or worsen existing periodontal disease and this will affect about 3 out of every 4 pregnant women[41]. In turn this exposes them to increased risk of premature birth.

To date the consensus of available findings from a number of studies strongly support the concept that maternal periodontal disease is associated with prematurity[43,44,45]. These studies provide some of the clearest evidence relating oral health to general health. However, it is not as clear how treatment of the periodontal disease will reduce the risk of preterm birth[46]. Nonetheless, a recent study of periodontal disease treatment in pregnant women revealed a strong link between unsuccessful periodontal disease treatment and preterm birth[47].

Pre-eclampsia (high blood pressure in pregnancy) is one of the significant problems in human pregnancy and complicates 8 – 10% of all pregnancies[48]. It affects the unborn baby as well as the mother and may result in premature birth. Indications for an association between periodontal disease and pre-eclampsia have also been found[49].

Aspiration pneumonia

A relationship has been suggested between poor oral health and aspiration pneumonia (inhaling bacteria that cause lung infection) among elderly people[50,51]. Risk factors include problems with swallowing, needing help with feeding, and the infective contribution of poor oral hygiene and dental decay.

Stomach ulcers

A recent study has shown that patients with poor oral hygiene are more likely to have 'H. pylori', the bacterium that causes stomach (peptic) ulcers, both in plaque on their teeth and in the stomach. This finding suggests that the mouth may be a reservoir for H. pylori, and potentially a source of transmission or reinfection[52].

Oral cancers

Studies indicate that periodontal disease and use of daily mouthwash containing alcohol, may be independent causes of cancers of the head, neck, and oesophagus[53].

Possible explanations for relationships with chronic disease Scientists are currently exploring several mechanisms that may connect and explain why periodontal diseases are related to chronic conditions discussed above[54]. Studies suggest that in people with periodontal disease, chewing and tooth-brushing may release harmful bacteria into the bloodstream. This may cause problems elsewhere in the body. For example, several kinds of bacteria that cause periodontal disease have been found in patients' hardened arteries in the heart and elsewhere, and in the fluid surrounding the unborn baby (amniotic fluid).

Oral bacteria could also harm blood vessels or cause blood clots by releasing toxins that resemble proteins found in artery walls or the bloodstream. The immune system's response to these toxins could harm vessel walls or make blood clot more easily. It is also possible that inflammation in the mouth "revs up" inflammation throughout the body, including in the arteries, where it can lead to heart attack and stroke[55,56].

Functional limitations affect diet and nutrition
Severe dental decay and periodontal diseases may both eventually lead to loss of teeth, which in turn may lead to difficulties in chewing which is a significant functional limitation. In addition pain is commonly found in patients with dental problems. Tooth loss is directly associated with deteriorating diet and compromised nutrition[57]. Difficulty eating a balanced diet from chewing problems and or pain, results in a reduction in the intake of fruit, vegetables, meat, and therefore protein, vitamins and fibre. This in turn impacts on the development of major chronic diseases. Chewing capacity has been reported to decrease in individuals with fewer than 20 natural teeth. This effect is quite marked. Individuals who had fewer than 12 natural teeth experienced levels of chewing incapacity similar to that of people who had lost all of their teeth (National Health & Medical Research Council, 1994)[58]. This was despite the frequent use of partial dentures by people who had fewer than 12 natural teeth. It has been reported that in older people wearing dentures, chewing capacity may be reduced to as low as one-sixth that of people with natural teeth[59]. Conversely when tested using a 14-item Oral Health Impact Profile[60] oral health-related problems were markedly reduced where the number of a patient's natural teeth exceeded 20[61].

A number of studies[62,63,64] have shown that older adults wearing complete dentures tend to have lower intakes of proteins and vitamins A and C than those with natural dentition, as they tend to have relatively low intake of difficult-to-chew food items, such as root vegetables, fruits and meat. Such adults are at an increased risk of experiencing malnutrition[65]. These problems not only contribute to reduced dietary and nutrient intake but also to loss of body weight, especially in later life[66,67,68].

Obesity

Studies are continuing in an effort to determine the relationship between obesity and oral health. Obesity is a risk factor for hypertension, blood fat abnormalities, heart disease and stroke, and there is now evidence that obesity is also associated with periodontitis[69]. High waist circumference was shown to be associated with periodontitis in young adults aged 18–34 years, but not in older adults[70]. Saito et al have shown a relationship between upper body obesity and periodontal disease in adults[71].

Overweight children in public and private schools in the US have also been shown to be more likely to have dental decay than non-obese children[72]. While some studies of the relationship with decay are conflicting, it has been recently found that areas of decay between teeth were more frequently diagnosed in teenagers of 15 years who were overweight (ISO-Body Mass Index >25) compared to normal-weight individuals[73]. A recent study has shown that childhood obesity is associated with reduced flow rate of saliva and dental decay[74].

Similarly Larsson et al., showed that adolescents with higher numbers of decayed, missing or filled teeth tended to be obese[75,76]. Cullinan et al.[77] recommend that clinicians need to be aware that patients with abdominal obesity may also have a greater burden of infection, placing them, not only at greater risk for periodontitis, but also compounding their risk for heart disease as discussed above.

2. Poor oral health causes disability

Oral disease creates social impacts

The *Healthy Mouths, Healthy Lives*[78] report states:

> "The impact of oral disease on people's every day lives is subtle and pervasive, influencing eating, sleep, rest and social roles. Collectively, oral diseases and disorders create substantial pain and suffering, disability and, in certain cases, death".

In addition to the functional limitations already described, dental problems result in loss of productivity from time off school and work[79,80].

Older data showed that oral disease represented 1 percent of the Australian total disability adjusted life years[81] comparable with acute respiratory infection, melanoma, lymphoma, falls, and heroin or poly-drug use. However, the *Healthy Mouths, Healthy Lives* report states that re-evaluation based on Australian data lifted oral diseases from the 17th to 7th ranking disease/disorder.

3. Oral health issues and major diseases share common risk factors

There is a strong argument for a 'common risk factor' population health approach to prevention. For example, many oral cancers are associated with tobacco and alcohol use[82,83], and lip cancers are mostly associated with sun exposure. Oral health itself is determined by a multitude of factors, including diet, hygiene, smoking, alcohol use, stress and trauma. These factors are common to a number of other chronic diseases, such as heart disease, cancer, and strokes[84].

Therefore, both oral and general health share possible causes and risk behaviours. Moreover, poor oral health and poor general health are likely to occur together and have an impact on each other. For example, nutritional

deficiency and impairment of the immune system have been associated with oral, as well as with general disease[85]. It is also well documented in the literature that systemic disease such as stress[86], diabetes (described above), human immunodeficiency virus infections, and leukaemia increase risk levels for severe periodontal disease[87].

In addition, tobacco smoking and alcohol consumption have been known for some time to be associated with periodontal disease and complete tooth loss[88,89,90], and oral cancer. One large case-control study showed[91] that the risk of cancer in the mouth and pharynx increased more than 35 times in individuals who consumed two or more packs of cigarettes and more than four alcoholic drinks per day.

4. General health problems may cause or worsen oral health conditions

General health problems may show up in the mouth. For example, people living with diabetes are more likely to suffer from infections such as oral thrush.

Some treatments for thinning of the bones, and bone loss due to cancer spread may create jaw problems including pain, swelling, numbness, loose teeth, periodontal

infection, or slow healing after an injury or surgery involving the gums and supporting bone[92]. Similar symptoms are likely to develop in people who have been treated with chemotherapy, radiation (to the head and neck), or steroids.

Many medications (such as treatments for high blood pressure and epilepsy) that lead to dry mouth therefore

increase the patient's risk of dental decay and periodontal disease. This may increase the rate of tooth loss.

Anxiety is associated with teeth grinding and clenching which may cause premature tooth wear, tooth cracking and damage to fillings, jaw disorders and headaches[93]. General impairment, for example in the elderly with physical or mental impairment, can cause difficulty in maintaining oral health care.

Relevance to periodontal disease in Australia
The recent Dental Costs Study[94] (DCS) has shown convincing evidence of poor oral health in 246 study participants attending a public dental service in Victoria. Compared with the results of the National Survey of Adult Oral Health (NSAOH 2004–2006[95]), more adults in this study had:

- Inadequate remaining teeth—20 or fewer natural functional teeth (51% DCS vs 11% NSAOH)
- High levels of gum disease - advanced gum disease (22.2% vs 2.4%) and moderate gum disease (53.6% vs 20.5%).

Only nine (3.6%) out of 246 people in the study had at least 20 natural functional teeth and all associated supporting periodontal tissues healthy.

Conclusion

Dental decay is the second most costly diet-related disease in Australia, with an economic impact comparable with heart disease and diabetes. Evidence clearly demonstrates that these diseases are not just limited to the mouth, but importantly are linked to general health outcomes.

Examining the links between oral and general health is now the focus of increasingly sophisticated studies. Well-designed large-scale longitudinal studies are required to determine whether causal links exist, the strengths of those links and the optimum timing and types of treatment to reduce risks. However, good oral health can be advocated on the basis of current evidence. Robust studies have shown that cardiovascular diseases, diabetes and complications of diabetes, respiratory infections, stroke, and adverse pregnancy outcomes are significantly associated with tooth loss and periodontal disease[96]. Cullinan et al (2009)[97] conclude that "adult oral health can no longer be ignored" in designing overall national health strategies. Protect natural teeth from decay and periodontal disease, and a strong focus on early detection and prevention of these disorders is crucial.

To achieve this, Dental Health Services Victoria (DHSV) recommends incorporating oral health into all health and health related policies, plans and curriculums at a local, State and Federal government level.

Oral disease is largely preventable. DHSV also recommends:

- A stronger preventive intervention focus to reduce hospital admissions and the severity of oral disease
- Improving oral health literacy
- Communicating clear oral health messages
- The inclusion of oral health as a health promotion priority[98].

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Glossary of terms

AIHW: Australian Institute of Health and Welfare.

BMI (Body Mass Index): A measure commonly used to measure overweight and obesity. The BMI is a relationship between weight and height that is associated with body fat, nutritional status and health risk. BMI is determined by your weight in kg divided by your height in metres.

CKD: Chronic kidney disease

COPD: Chronic Obstructive Pulmonary Disease

CVD: Cardiovascular disease

DCS: Dental Costs Study

Dental caries: Tooth decay.

Dentist: An appropriately qualified oral health care provider registered to practise all areas of dentistry.

Diabetes: Diabetes mellitus (sometimes called "sugar diabetes") is a condition that occurs when the body can't use glucose (a type of sugar) normally. Glucose is the main source of energy for the body's cells. The level of glucose in the blood is controlled by a hormone called insulin, which is made by the pancreas. Insulin helps glucose enter the cells. In diabetes, the pancreas does not make enough insulin (type 1 diabetes) or the body can't respond normally to the insulin that is made (type 2 diabetes). This causes glucose levels in the blood to rise, leading to symptoms such as increased urination, extreme thirst, and unexplained weight loss.

DHSV: Dental Health Services Victoria

Early intervention: Treatments or advice targeting people displaying the early signs and symptoms of an illness. Early intervention also encompasses the early identification of people suffering from a disorder.

Edentulous/edentulism: Complete loss of all natural teeth.

Gingivitis: a mild form of gum disease

Haemoglobin A1c: Glycosylated haemoglobin. A blood test can measure the amount of glycosylated haemoglobin in the blood. The glycosylated haemoglobin test shows what a person's average blood glucose level was for the 2 to 3 months before the test. This can help determine how well a person's diabetes is being controlled over time.

Health promotion: The process of enabling individuals and communities to increase control over and improve their health. It involves the population as a whole in the context of their everyday lives rather than focusing on people at risk for specific diseases, and is directed toward action on the determinants of health (WHO 1986).

Hypertension: High blood pressure

Meta analysis: A method of summarizing previous research by reviewing and combining results from multiple studies. National Health and Medical Research Council: The National Health and Medical Research Council is Australia's leading expert body promoting the development and maintenance of public and individual health standards.

Oral health: "....oral health means much more than healthy teeth. It means being free of chronic oral- facial pain conditions, oral and pharyngeal (throat) cancers, oral soft tissue lesions, birth defects such as cleft lip and palate, and scores of other diseases and disorders that affect the oral, dental, and craniofacial tissues, collectively known as the craniofacial complex." (U.S. Department of Health and Human Services 2000, page 17.)

Outcome: A measurable change in the health of an individual, or group of people or population, which is attributable to an intervention or series of interventions (The NSW Health Outcomes program". New South Wales Public Health Bulletin) Periodontal disease: Disease of the gum and/or the bone surrounding the teeth, characterized by a receding of the gums, spaces opening between teeth, inflammation/infection, discomfort in the gums, loss of bony support to and consequent loosening of the teeth.

Population health: The health of the population, measured by health status indicators. It is influenced by physical, biological, social and economic factors in the environment, by personal health behaviour, health care services etc. Also, the prevailing or aspired level of health in the population of a specified country or region, or in a defined subset of that population (Last 2001).

Pre-eclampsia: A condition in pregnancy characterized by abrupt rise in blood pressure, leakage of large amounts of the protein albumin into the urine and swelling of the hands, feet, and face. Preeclampsia is the most common complication of pregnancy. In some cases, untreated preeclampsia can progress to eclampsia, a life-threatening situation for both mother and baby characterized by coma and seizures. If treatment is ineffective, early delivery of a premature baby may have to be considered.

Prevention: 'Interventions that occur before the initial onset of a disorder' (Mrazek & Haggerty 1994, p23).

PVD: Peripheral vascular disease

SBE: An infection of damaged heart valves called subacute bacterial endocarditis

WHO: World Health Organization.

Dental Health Services Victoria is the state's leading public oral health agency, promoting oral health, purchasing services and providing care to Victorians.

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