

Diabetes

Diabetes and oral health

Conclusion

People newly diagnosed with diabetes should undergo a full oral examination including a full periodontal examination. Regular monitoring of the periodontal status of people with diabetes is advised.

The dental practitioner has an important role in the management of patients with diabetes. This role includes referral to a medical practitioner of patients with signs and symptoms indicative of diabetes, working closely with the medical practitioner in management of oral complications, specific monitoring of the oral environment, and treatment of conditions related to diabetes.

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Periodontal disease – the sixth complication of diabetes

The diabetes epidemic – in Australia the prevalence of type 2 diabetes has doubled over the past 20 years, and is now occurring in children and adolescents.

Research has confirmed that people with diabetes are more likely to have gingivitis and periodontal disease, particularly when diabetes is poorly controlled. Recent evidence suggests that periodontal disease may make it more difficult for people who have diabetes to control their diabetes.

What is diabetes?

Diabetes mellitus is a chronic endocrine disorder affecting carbohydrate, fat and protein metabolism. It is caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the reduced effectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many of the body's systems, in particular the blood vessels and nerves (WHO 2002).

There are several types of diabetes, with different causal mechanisms.

The three main types are:

Type 1 diabetes

Type 1 diabetes is an autoimmune disease which results in the body destroying its own insulin-producing cells in the pancreas. The pancreas then is not able to produce insulin. People with this condition require daily insulin therapy to survive. Type 1 diabetes used to be called insulin dependent diabetes mellitus (IDDM) or juvenile-onset diabetes.

Type 2 diabetes

Type 2 diabetes is marked by an inability of the pancreas to make enough insulin (insulin deficiency) and/or the inability of the body to use insulin properly (insulin resistance). Those at elevated risk of developing type 2 diabetes include:

- people with impaired glucose tolerance (IGT) and impaired fasting glucose
- Aboriginal and Torres Strait Islander peoples aged 35 years and over
- Pacific Islander people, people from the Indian subcontinent and people of Chinese origin, aged over 35 years
- people aged 45 years and over who are obese or have hypertension
- all people with clinical cardiovascular disease
- women with polycystic ovarian syndrome who are obese
- women who have had gestational diabetes
- people over 45 years old with a first degree relative who has diabetes

(Australian Government Department of Health and Ageing 2005).

Gestational diabetes

Gestational diabetes occurs during pregnancy in about 3–8% of females not previously diagnosed with diabetes. Screening tests for gestational diabetes are usually performed around the 24th to the 28th week of pregnancy. It is a temporary form of diabetes and usually disappears after the baby is born. However, it is a marker of much greater risk of developing type 2 diabetes later in life.

Epidemiology

Diabetes is the sixth leading cause of death in Australia, claiming over 3,300 lives and costing the nation more than \$1.2 billion a year.

Type 1 diabetes accounts for around 10–15% of all people with diabetes. It is a disease which begins in adolescence or young adulthood, with peak incidence at about 10–12 years of age in girls and 12–14 years in boys. Based on self-reported information from the 2001 National Health Survey in Australia, it is estimated that around 95,000 Australians (0.5% of the population) have type 1 diabetes.

Type 2 diabetes is more common in people aged 40 years or older, and 85–90% of those with diabetes have this form of the disease. The risk of developing type 2 diabetes increases with age (Figure 1). However, rates of diabetes are increasing in all age groups including children and adolescents. It is thought that up to half of all people with type 2 diabetes are unaware that they have the condition.

The Ausdiab Study using blood testing found that about 850,000 Australians aged 25 years and over had type 2 diabetes, representing 7.2% of the population (7.6% of males and 6.7% of females). Aboriginal and Torres Strait Islander people, Pacific Islander people, and people from the Indian subcontinent or of Chinese origin have higher rates of diabetes (AIHW 2005). In fact, some Aboriginal and Torres Strait Islander communities have among the highest rates in the world (30%). Indigenous Australians who have type 2 diabetes often develop the disease earlier than other Australians and die at younger ages.

Treatment

Diabetes is a chronic condition which can be controlled rather than cured. Treatment for type 1 diabetes is through daily insulin therapy. Currently this requires injections but new modalities of insulin therapy such as inhalation may become available.

Type 2 diabetes may be controlled initially by weight reduction, exercise and improved diet. Oral medications may be prescribed if the lifestyle changes are insufficient to control the disease, and in the long term insulin may be required.

The extent to which diabetes is controlled is assessed by measuring the levels of blood glucose and glycosylated haemoglobin (HbA1c). A measure of long-term glycaemic control in people with diabetes, HbA1c is produced by the non-enzymatic glycosylation of haemoglobin at a rate proportional to the prevailing glucose concentration. The level of HbA1c depends upon the:

- red cell lifespan
- prevailing blood glucose concentration.

Providing the red cell lifespan is normal, HbA1c measures the mean blood glucose concentration over the preceding 60 days, i.e. the half-life of the red cell lifespan. Recommended levels of blood glucose and HbA1c are listed in the table below.

Table 1: Recommended levels of blood glucose and HbA1c.

Type of Test	Goal
Blood glucose level:	
Before meal	4 – 6 millimoles/litre
After meal	4 – 7.7 Millimoles/litre
HbA1c (glycosylated haemoglobin) tested every 4 – 6 months	Type 1 diabetes 7.0 – 7.5% Type 2 diabetes <6.5%

Source: RACGP Guidelines

Pathophysiology

Diabetes leads to abnormal glucose metabolism. Glucose is needed by cells for growth, maintenance and energy. When insulin production is impaired or absent, or when there is insulin resistance, glucose is not able to be transferred to tissues which are insulin dependent (e.g. muscles, fat and liver) and thus the glucose level in the blood rises (hyperglycaemia).

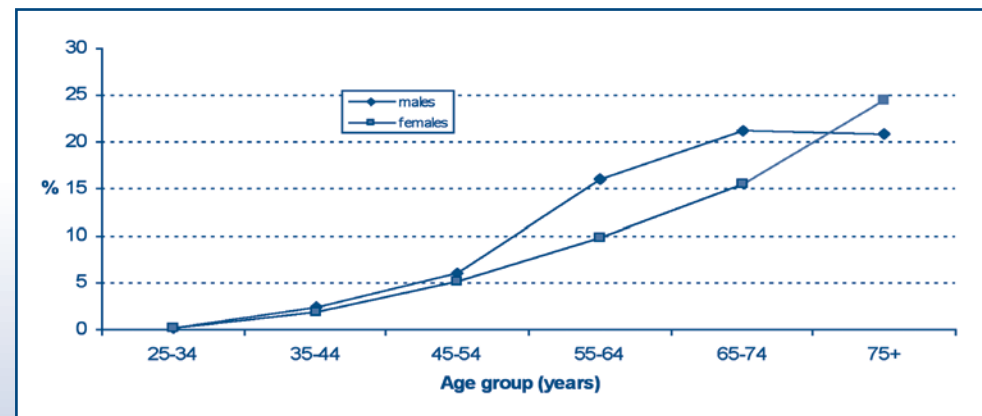
Hyperglycaemia causes damage to blood vessels. Other problems caused by diabetes are an altered inflammatory response, an increase in oxidative stress and changes in lipid metabolism.

Systemic complications

The long-term systemic complications of diabetes are largely related to changes in large and small blood vessels which increase the risk of:

- heart disease and stroke
- foot ulceration, gangrene and lower limb amputation
- renal failure
- visual impairment up to and including blindness from retinopathy, glaucoma, cataract and corneal disease
- neuropathy (the most common complication), which leads to sensory loss and damage to the limbs, and is also a major cause of impotence in men
- periodontal diseases (Loe 1993).

Figure 1: Age-specific prevalence rates of type 2 diabetes among Australians aged 25+, 1999-2000



Source: AIHW 2002. Diabetes: Australian facts 2002. AIHW Cat. No. CVD 20 (Diabetes Series No.3). Canberra: AIHW.

Diabetes and gingivitis

People with type 1 diabetes have a greater risk of developing gingivitis. More gingival inflammation and higher gingival bleeding scores are found in children with diabetes than children without diabetes after accounting for plaque scores.

Type 2 diabetes is also associated with gingivitis that may be related to glycaemic control (Ryan & Kamar 2003).

Diabetes and periodontitis

Epidemiological studies have confirmed that patients with diabetes, both type 1 and type 2, are more susceptible to periodontal diseases (Genco 1996). Both gingivitis and periodontitis are more severe if the person with diabetes is a smoker (US Department of Health and Human Services 2000).

The extent of the risk, however, relates to the duration and control of the diabetes, with the likelihood of periodontal disease increasing markedly when diabetes is poorly controlled (Garcia 2001; Tsai et al. 2002). In fact, the presentation of multiple and recurrent periodontal abscesses can often be pathognomonic for untreated and uncontrolled diabetes.

Diabetes leads to more rapid and severe progression of destructive periodontitis (Southerland et al. 2006). Diabetes increases the risk of severe periodontitis at least 2-fold (Tsai 2002; Khader et al. 2006) and also doubles the rate of periodontal disease progression (Yalda 1994).

Research has emerged that suggests that the relationship between periodontal disease and diabetes goes both ways – not only do people with diabetes have more severe periodontal disease, but periodontal disease may make it more difficult for people who have diabetes to control the condition (US Department of Health and Human Services 2000). Poorer glycaemic control leads to both an increased risk for alveolar bone loss and more severe progression of periodontal disease. In addition, there may be a gradient, with the risk for bone loss in those patients with better controlled diabetes being intermediate between that of those with poorly controlled diabetes and those without diabetes (Taylor et al. 1998).

However, more research needs to be undertaken to confirm that treatment of periodontal disease can improve glycaemic control (Janket et al. 2005; Taylor et al. 2004).

Diabetes and periodontal disease are also related in children and adolescents. Diabetes has been identified as a risk factor for periodontal destruction in 6–11-year-old children, but becomes an even more important risk factor after 12 years of age (Lalla et al. 2006).

Pathophysiology of periodontal disease in diabetes

The increased prevalence and severity of periodontal disease in people with diabetes is multifactorial in origin. The following mechanisms may operate:

1. Degenerative vascular changes (Ryan et al. 2003)
2. Impaired neutrophil function (Ryan et al. 2003)
3. Excessive inflammatory response at the site of infection and systemically altered inflammatory response associated with cytokine dysfunction (Graves et al. 2006)
4. Collagen turnover defects including decreased collagen synthesis and increased collagenase activity (Ryan et al. 2003)
5. Impaired wound healing due to decreased growth factors (Southerland et al. 2006)
6. Enhanced programmed cell death of fibroblasts and osteoblasts resulting in suppression of new bone repair following bone resorption (Graves et al. 2006)
7. Oxidative stress resulting in accelerated tissue injury (Karima et al. 2005). Oxidative stress is the steady state level of oxidative damage in a cell caused by the reactive oxygen species, and is important in the pathogenesis of diabetes and its complications.

Periodontal treatment of patients with diabetes

Periodontal diseases respond well to treatment and can be managed successfully in patients with well-controlled diabetes. Such therapy may result in improvements in the diabetes condition itself (Grossi et al. 1997; Kiran et al. 2005), although the research results have not been consistent across all studies. In treating a patient with diabetes who also has periodontal disease it is important to:

- work with the patient's medical practitioner in monitoring diabetic control
- encourage the maintenance of meticulous oral hygiene practices
- provide advice and support for cessation of smoking
- schedule regular recall appointments.

Treatment of periodontal disease in a patient with diabetes should be very similar to that of a patient without diabetes if the condition is well controlled. If the diabetes is poorly controlled or is difficult to control, some modifications of treatment may be necessary to allow for poorer response to therapy including wound healing. Use of systemic antibiotics in association with other treatment modalities may assist in achieving improved levels of glycosylated haemoglobin, the marker of diabetic control (Grossi 2001).

- Monitoring the periodontal condition of women with a history of gestational diabetes may be appropriate given their high risk of developing type 2 diabetes later in life.

Other oral conditions and diabetes

Diabetes has also been related to other oral conditions: *Dental caries*: The relationship between dental caries and diabetes has been examined but remains unclear.

Salivary dysfunction: People with diabetes with poor glycaemic control may experience dry mouth caused by increased urination or alterations in the salivary glands. Correlations between salivary levels of glucose and blood levels have led to suggestions that saliva may be a less intrusive vehicle to diagnose and monitor diabetes.

Oral infections: Altered immunological systems experienced by people with diabetes increase the prevalence of opportunistic infections such as oral candidiasis. Such infections may also be associated with salivary hypofunction, and may indicate diabetes in an undiagnosed person.

Oral mucosal diseases: Certain oral mucosal disorders have been associated with diabetes. They include lichen planus and recurrent aphthous ulceration.

Other conditions: Taste disturbances and neurosensory disorders may affect diet and oral hygiene (Ship 2003).

Management of dental patients with diabetes

It is very important to work closely with medical practitioners in the management of patients with diabetes, particularly where the condition may be poorly controlled. Other factors which should be considered are:

- regular full periodontal examinations for patients with diabetes
- the use of antibiotics in association with surgery for patients with poorly controlled diabetes because of their susceptibility to infection
- adjustment of insulin or oral hypoglycaemics, in consultation with the medical practitioner, when undertaking invasive or stressful procedures or in the presence of an acute oral infection
- blood glucose levels should be monitored prior to surgical treatment
- monitoring of glycaemic control by regularly checking the patient during treatment
- glucose sources should be available at the dental surgery in case of a hypoglycaemic event
- tissues should be handled as atraumatically and minimally as possible.

Guidelines for dental visits

- The clinician should make sure that prescribed insulin or oral medication has been taken, followed by a meal.
- Morning appointments are appropriate because of optimal insulin levels.
- Refer to periodontist if periodontal condition deteriorates.

Complications of diabetes

Hypoglycaemia:

Hypoglycaemia can occur even in a person with well-controlled diabetes. Most patients recognise the symptoms – sweating, tremor/trembling, palpitations/pounding heart, anxiety, tiredness, pallor, headache, hunger, dizziness, irritability, blurred vision, aggressive behaviour, slurred speech, confusion, drowsiness, convulsions, coma.

Management: Give sweets, liquid glucose or orange juice if the patient is feeling unwell. If the patient has more severe symptoms such as drowsiness, convulsions or coma, immediate medical assistance is required.

Hyperglycaemia:

Hyperglycaemia can be aggravated by infections and is more likely to occur in a person with undiagnosed diabetes. The symptoms are weakness, tiredness, frequent urination, increased thirst, blurry vision and itchy skin.

Management: Refer the patient to a medical practitioner.