

The Relationship Between Diabetes and Periodontal Disease

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A b s t r a c t

There is good evidence to support the claim that periodontitis may be more prevalent among diabetic patients than nondiabetic people. Similarly, studies have shown that periodontal therapy influences glycemic control in people with diabetes mellitus. Given that nearly 10% of Canadians are affected by either type 1 or type 2 diabetes (including those in whom the disease is undiagnosed), all dentists will encounter patients with diabetes. Dental practitioners must be aware of the implications of this relationship and manage their patients' periodontal care accordingly.

MeSH Key Words: diabetes mellitus/complications; periodontal diseases/complications; risk factors

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By the year 2010, it is expected that 3 million Canadians will be afflicted with diabetes mellitus.¹ It has been reported that for every person known to have diabetes, there is someone else in whom the disease remains undiagnosed.² In other words, up to 10% of Canadian adults may currently have diabetes. This means that dentists will regularly encounter diabetic patients. This paper discusses the possible impact of diabetes on the periodontal patient and the ways in which untreated periodontitis may influence the course of diabetes.

What Is Diabetes?

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia due to defective secretion or activity of insulin.¹ In the current classification of this condition, the terms "insulin-dependent diabetes mellitus" and "non-insulin-dependent diabetes mellitus" are not used, in part because they relate to treatment rather than to the diagnosis. A conclusive diagnosis of diabetes mellitus is made by assessing glycated hemoglobin levels; in those people with diabetes, sequential fasting plasma glucose levels will be 7 mmol/L or more.

Diabetes mellitus can be classified into 1 of 4 broad categories according to signs and symptoms.

Type 1 diabetes mellitus encompasses diabetes resulting primarily from destruction of the beta-cells in the islets of Langerhans of the pancreas. This condition often leads to absolute insulin deficiency. The cause may be idiopathic or

due to a disturbance in the autoimmune process. The onset of the disease is often abrupt, and patients with this type of diabetes are more prone to ketoacidosis and wide fluctuations in plasma glucose levels. If untreated, these patients are likely to manifest the classic signs and symptoms of diabetes: polyuria (excessive urine output), polydipsia (excessive thirst) and polyphagia (excessive appetite), as well as pruritis, weakness and fatigue. These patients are more likely to suffer severe systemic complications as a result of the disease.

The causes of **type 2 diabetes mellitus** range from insulin resistance with relative insulin deficiency to a predominantly secretory defect accompanied by insulin resistance. The onset is generally more gradual than for type 1, and this condition is often associated with obesity. In addition, the risk of type 2 diabetes increases with age and lack of physical activity, and this form of diabetes is more prevalent among people with hypertension or dyslipidemia. Type 2 diabetes has a strong genetic component, with the disease being more common in North Americans of African descent, Hispanics and Aboriginal people. People with type 2 diabetes constitute 90% of the diabetic population.

Gestational diabetes mellitus (GDM) is glucose intolerance that begins during pregnancy. The children of mothers with GDM are at greater risk of experiencing obesity and diabetes as young adults.³ As well, there is a greater risk to the mother of developing type 2 diabetes in the future.

A wide variety of relatively uncommon conditions fall into the category of "other specific types." These consist mainly of specific genetically defined forms of diabetes and diabetes associated with other diseases or drug use.

Complications of Diabetes

The complications of diabetes are related to long-term elevation of blood glucose concentrations (hyperglycemia). Hyperglycemia results in the formation of advanced glycation end-products (AGEs).⁴ These AGEs act to "prime" endothelial cells and monocytes, making them more susceptible to stimuli that induce the cells to produce inflammatory mediators. Accumulation of AGEs in the plasma and tissues of diabetic patients has been linked to diabetic complications. There is some speculation that AGE-enriched gingival tissue has greater vascular permeability, experiences greater breakdown of collagen fibres and shows accelerated destruction of both nonmineralized connective tissue and bone.⁵ Apart from the accumulation of AGEs, the pathophysiology is strikingly similar to that of periodontal disease.

Long-term complications may occur in both type 1 and type 2 diabetes. Macrovascular complications include coronary artery disease, cerebrovascular disease and peripheral vascular disease. Microvascular complications include retinopathy, nephropathy and neuropathy. Retinopathy may lead to blindness, whereas progressive renal disease can lead to kidney failure. Peripheral neuropathy may lead to loss of limbs and dyesthesias (burning sensations).³ In terms of oral manifestations, the patient may experience delayed wound healing and xerostomia, as well as an increased susceptibility to periodontal disease⁶ (see **Table 1**).

Periodontal Disease as a Complication of Diabetes

Periodontitis has been referred to as the sixth complication of diabetes.⁶ A number of studies found a higher prevalence of periodontal disease among diabetic patients than among healthy controls.⁸ In a large cross-sectional study, Grossi and others⁹ showed that diabetic patients were twice as likely as nondiabetic subjects to have attachment loss. Firatli⁸ followed type 1 diabetic patients and healthy controls for 5 years. The people with diabetes had significantly more clinical attachment loss than controls. In another cross-sectional study, Bridges and others¹⁰ found that diabetes affected all periodontal parameters, including bleeding scores, probing depths, loss of attachment and missing teeth. In fact, one study has shown that diabetic patients are 5 times more likely to be partially edentulous than nondiabetic subjects.¹¹ People with type 1 and type 2 diabetes appear equally susceptible to periodontal disease and tooth loss.

Other factors are involved in the high prevalence of periodontal diseases in association with diabetes. The relation-

Table 1 Oral complications of diabetes mellitus^a

Long-term diabetic complication	Oral implications
Microvascular disease	Xerostomia Greater susceptibility of oral tissues to trauma More opportunistic infections (e.g., candidiasis) Greater accumulation of plaque Greater risk of caries Delayed wound healing Greater susceptibility to periodontal disease
Peripheral neuropathy	Oral paresthesia, including burning mouth or tongue Altered taste sensations

^aAdapted from Rees.⁷

ship between diabetes and periodontal disease appears to be very strong within certain populations, such as Aboriginal peoples,^{12,13} which indicates a genetic component. A recent study found that smoking increases the risk of periodontal disease by nearly 10 times in diabetic patients.¹⁴ According to these results, the *management of diabetic patients should include strong recommendations to quit smoking*. For both type 1 and type 2 diabetes, there does not appear to be any correlation between the prevalence or the severity of periodontal disease and the duration of diabetes.^{11,15}

The Effect of Periodontitis on Diabetes

Recent investigations have attempted to determine if the presence of periodontal disease influences the control of diabetes. There appears to be good evidence to support this hypothesis. Grossi and others¹⁶ have suggested that effective control of periodontal infection in diabetic patients reduces the level of AGEs in the serum. The level of glycemic control seems to be the key factor. Tervonen and Karjalainen¹⁷ followed diabetic patients and nondiabetic controls for 3 years. They found that the level of periodontal health in diabetic patients with good or moderate control of their condition was similar to that in the nondiabetic controls. Those with poor control had more attachment loss and were more likely to exhibit recurrent disease. This phenomenon has been pointed out by other researchers.¹⁸⁻²⁰ From this, we can conclude that *prevention and control of periodontal disease must be considered an integral part of diabetes control*.

The principles of treatment of periodontitis in diabetic patients are the same as those for nondiabetic patients and are consistent with our approach to all high-risk patients who already have periodontal disease (see **Table 2**). Major efforts should be directed at preventing periodontitis in patients who are at risk of diabetes (see **Table 3**). Diabetic patients with poor metabolic control should be seen more

Table 2 Periodontal maintenance for diabetic patients

Patient characteristics ^a	Periodontal maintenance	Frequency
Diabetes well controlled		
Healthy periodontium; no or minimal localized gingivitis	Record probing depths and bleeding score; deplaque	Annually
Healthy periodontium, generalized gingivitis	Record probing depths and bleeding score	Annually
	Deplaque; OHI	Every 6 months
Chronic, mild to moderate periodontal disease	Record probing depths and bleeding score	Annually
	Deplaque; OHI	Every 3–4 months
Advanced attachment loss or aggressive (early onset) periodontal disease	Refer management to periodontist if possible	
	If referral not possible, monitor	Every 3 months
	Record probing depths and bleeding score	Annually
	Check probing depths and bleeding score; deplaque; OHI	At each visit
Diabetes poorly controlled		
Healthy periodontium; no or minimal localized gingivitis	Record probing depths and bleeding score	Every 6 months
	Deplaque; OHI	Every 6 months
Healthy periodontium, generalized gingivitis	Record probing depths and bleeding score	Annually
	Deplaque; OHI	Every 4–6 months
Chronic, mild to moderate periodontal disease	Refer if possible	
	If referral not possible, monitor	Every 3 months
	Record probing depths and bleeding score	Annually
	Check probing depths and bleeding score; deplaque; OHI	At each visit (every 3 months)
Advanced or aggressive periodontal disease	Refer if possible	
	If referral not possible, monitor	Every 3 months
	Record probing depths and bleeding score	Annually
	Check probing depths and bleeding score; deplaque; OHI	At each visit

^aType 1 or type 2 diabetes
OHI = Oral hygiene instruction

Table 3 Risk factors for diabetes^a

Family history of diabetes mellitus
Previous gestational diabetes
Dyslipidemia
Infertility, hirsutism
Obesity
Smoking

^aAdapted from Meltzer and others.³

frequently, especially if periodontal disease is already present. Patients with well-controlled diabetes who have good oral hygiene and who are on a regular periodontal maintenance schedule have the same risk of severe periodontitis as nondiabetic subjects. ♦

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