The Two-Way Relationship Between Diabetes and Periodontal Disease

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The Two-Way Relationship Between Diabetes and Periodontal Disease

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Diabetes mellitus (DM) is a highly prevalent metabolic disease, affecting one in ten Canadians. In many of these people, the disease remains undiagnosed.[1,2] More importantly, the prevalence of DM has tripled since 1970. This is a significant finding for dental professionals, as evidence from clinical research showing a strong relationship between diabetes and periodontal disease is mounting. In fact, periodontitis is often referred to as the sixth complication of diabetes.[3]

Further research suggests that control of periodontal disease may play a key role in the control of diabetes. Thus, dentists must be aware of the signs and symptoms of diabetes, and understand the importance of maintaining periodontal health for anyone with diabetes.

What is Diabetes Mellitus?

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia due to defective secretion or activity of insulin.[1] It may be further complicated by poor regulation of protein and lipid metabolism. 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 is normally a result of autoimmune destruction of the beta-cells in the islets of Langerhans of the pancreas. This condition often leads to absolute insulin deficiency. It is believed that the tendency to develop the abnormal antibodies in type 1 DM is, in part, genetically inherited, though the details are not fully understood. Exposure to certain viral infections (mumps and Coxsackie viruses) or other environmental toxins may serve to trigger abnormal antibody responses that damage the beta cells.

Type 1 diabetes tends to occur in young, lean individuals, usually before 30 years of age; however, older patients do present with this form of diabetes on occasion. This subgroup is referred to as latent autoimmune diabetes in adults (LADA). LADA is a slow, progressive form of type 1 diabetes. Only approximately 10% of the patients with DM have type 1 diabetes and the remaining 90% have type 2 diabetes mellitus. The patient with type 1 diabetes must rely on insulin medication and close dietary control for survival.

With type 2 diabetes, patients can still produce insulin, but do so relatively inadequately. In many cases, the pancreas produces larger than normal quantities of insulin. A major feature of type 2 diabetes is a lack of sensitivity to insulin by the cells of the body, particularly fat and muscle cells. These larger quantities of insulin are produced as an attempt to get these cells to recognize that insulin is present. In addition to the problems with an increase in insulin resistance, the release of insulin by the pancreas may also be defective, and occur late in response to increased glucose levels. Finally, the liver in these patients continues to produce glucose despite elevated glucose levels.

There is a direct relationship between the degree of obesity and the risk of developing type 2 diabetes in both children and adults. It is estimated that the chance to develop diabetes doubles for every 20% increase over desirable body weight and for each decade after 40 years of age, regardless of weight. The prevalence of diabetes in persons 65 to 74 years of age is nearly 20%.[4,5] Compared with a 6% prevalence in Caucasians, the prevalence in African Americans and Asian Americans is estimated to be 10%, in Hispanics 15%, and in certain Native American tribes 20% to 50%.[1,6] 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.[7] 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, such as pancreatitis or drug use.

Complications of Diabetes

Long-term complications may occur in both type 1 and type 2 diabetes.[3,7] Diabetes accelerates atherosclerosis of the larger blood vessels, leading to coronary heart disease (angina or heart attack), strokes, and pain in the lower extremities because of lack of blood supply. Microvascular complications include retinopathy (which may lead to blindness), nephropathy (possibly leading to kidney failure) and neuropathy.

Table 1 Oral complications of diabetes mellitus[8,9]

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
	Greater susceptibility to periodontal disease
	Greater risk of developing periodontal abscesses when periodontitis is present
	Delayed healing
Peripheral neuropathy	Oral paraesthesia, including burning mouth or tongue
	Altered taste sensations

The Effect of Diabetes on Periodontal Health

Numerous studies have found a positive relationship between poor glycemic control in persons with type 2 DM and increased periodontitis. One five-year longitudinal study found increased attachment loss in diabetic adolescents, whereas non-diabetic subjects had stable attachment levels.[10] A cross-sectional study of over 1400 subjects found diabetics to have 2.3 times increased risk for attachment loss.[11]

Taylor[12] recently published a qualitative systematic review examining the evidence for an adverse relationship between DM and periodontal disease. Of the 48 studies on children and adolescents with type 1 diabetes, all but one found an increased prevalence of periodontal disease compared to non-diabetic children. Of the eight reports limited to type 2 diabetics, all found significantly poorer periodontal health in diabetics. In fact, after controlling for other risk factors, the odds of having periodontitis in diabetics was increased by two and a half to four times. Similar findings have been reported elsewhere.[13,14] In all cases, the level of diabetic control was a significant factor. Subjects with diabetes who were able to maintain consistent glycemic levels had no greater risk than did healthy subjects. For both type 1 and type 2 diabetes, there does not appear to be any correlation between the prevalence or severity of periodontal disease and the duration of diabetes.

The literature provides consistent evidence of greater prevalence and severity of periodontal disease in diabetics, both types 1 and 2. As these studies were conducted in distinctly different settings, with heterogeneous subjects and using a number of different measures of periodontal disease, we can state with confidence that diabetics have an increased susceptibility to periodontitis related to diabetes control.

The Effect of Periodontal Health on the Course of Diabetes

Saito et al. (2003)[13,14] followed a cohort over a 10-year period. Subjects included people with normal glucose tolerance, impaired glucose tolerance and no glucose tolerance (diabetics). He found an increase in mean pocket depth was more closely associated with the development of glucose intolerance from normal status than the past glucose tolerance status itself. One-third of the subjects with impaired glucose tolerance or diabetes at the beginning of the 10-year study improved their glucose status to normal. In addition, the proportion with normal glucose tolerance was higher in subjects with shallower pocket depths than in those with deeper pockets.

Early studies attempted to determine if the presence of periodontal disease influences the control of diabetes[15,16] and reported that periodontal therapy may improve metabolic control of diabetes. Upon closer examination of the research, it was shown that mechanical periodontal treatment alone improves periodontal health, but had an effect of the level of glycosylated hemoglobin. However, the magnitude and duration of the improvement may not be clinically significant.

Periodontal Management of the Diabetic Patient

There is weak evidence from clinical trials that diabetics require more thorough and aggressive periodontal therapy than do non-diabetics with periodontal disease. Once the periodontal disease is under control, and the patient with diabetes remains on a maintenance program for strict plaque control at three-month intervals, the periodontal health will remain stable. Periodontal health may deteriorate more rapidly in poorly controlled diabetics than in other patients, and may not respond as well to traditional sanative therapy. Therefore, knowledge of patients' metabolic control is important for determining prognosis and recall intervals. For patients who do not respond well to initial therapy, it may be appropriate to select an antibiotic based on the results of microbial testing.[17] Doxycycline is normally the drug of choice because, in addition to its antimicrobial effects, it inhibits metalloproteinase activity and glycolysation.

While properly controlled diabetics can undergo all dental treatments without special precautions, the dentist must also be aware of the signs and symptoms of an acute hypoglycemic attack.

Signs and Symptoms of Acute Hypoglycemia

- dizziness
- pallor
- anxiety, including agitation and belligerence
- Sweating
- tachycardia
- weakness
- hunger

It is strongly advisable to have some form of rapidly absorbed glucose, such as orange juice, on hand when treating patients with diabetes. To avoid an episode of hyperglycemia consider the following

- Schedule the patient at their time of highest insulin activity. This depends upon the type of insulin used and may vary from 30 minutes to eight hours post-injection.
- Advise the patient not to change their insulin regimen or diet prior to their treatment.
- Have a blood glucose monitor in the office or ask patient to bring theirs to the appointment.
- Consider pre-operative sedation for anxious patients.

From this review of the clinical evidence to date, 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 non-diabetic 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. Diabetic patients with poor metabolic control should be seen more 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 non-diabetic patients.

Table 2 Periodontal maintenance for diabetic patients*

Patient characteristics	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	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

*Based on extrapolation of the evidence[18-21]

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