

# Diabetes and periodontal disease: Relationship and management

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**There is an increased incidence of periodontal disease among people with diabetes and obesity, and a growing body of evidence that suggests improving dental health may lead to improvements in glycaemic control. Healthcare professionals in dental and primary care should work together to identify individuals with periodontal disease at risk of progressing to chronic conditions, and ensure that those with diabetes and/or obesity are offered dental care in the same way people with diabetes are routinely offered retinal screening and foot care.**

The ever-growing burden of diabetes and obesity on health care and society has been widely reported in the medical literature and mainstream media, with these chronic conditions being described as global epidemics (World Health Organization, 2013). Though less widely discussed, periodontal disease is also a major health burden, with epidemiological studies revealing more than two-thirds of the world's population have some form of chronic periodontal disease (Dahiya et al, 2012).

This article examines the potential bidirectional relationship between periodontal disease and diabetes, and highlights the role the dental practitioner can play – alongside their colleagues in primary care – in both screening and caring for people with these conditions.

## Periodontal disease

Periodontal disease is an infectious, oral condition affecting the supporting structures of the teeth that is caused by the interaction between pathogenic bacteria and the host's immune system. Oral bacteria are required, but are alone insufficient, for disease initiation (Graves, 2008); persistent host inflammatory response is needed before the soft and mineralised periodontal tissues become eroded and disease is established (Graves, 2008; Liu et al, 2010).

Periodontal disease comprises gingivitis (Figure 1a) and periodontitis (Figure 1b).

Gingivitis – inflammation of the gum – is most-commonly associated with plaque build-up around a tooth and is usually reversible with good oral hygiene. If left untreated, gingivitis can lead to periodontitis.

Periodontitis is the more advanced stage of periodontal disease, occurring when microorganisms colonise and progressively destroy the periodontal ligament and alveolar bone, with pocket formation or recession (or both) around diseased teeth. This process is multifactorial and occurs in the presence of microbial challenge alongside other genetic,



Figure 1. Examples of (a) gingivitis and (b) periodontitis. Note that the bleeding of the gums from gingivitis usually precedes receding gums and bone loss associated with periodontitis.

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## Article points

1. Periodontal disease is an inflammatory condition that is linked to diabetes and obesity.
2. The significance of the link is not widely understood among healthcare professionals.
3. Dental practitioners should be part of an integrated healthcare team – alongside primary care professionals – that engages in screening, provision of preventative advice and education, and referrals for individuals at risk of chronic conditions.
4. Improving dental health may contribute to improved glycaemic control, reducing the risk of diabetes-related complications, although further studies are needed to firmly establish these relationships.

## Key words

- Dental health practitioner
- Diabetes
- Periodontal disease

## Authors

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**Page points**

1. There is evidence to suggest a bidirectional relationship between diabetes and periodontal disease; however, more research is needed to unequivocally establish a relationship between these conditions.
2. Meta-analysis and observational evidence suggest that periodontitis may also be related to the development of type 2 diabetes (and possibly gestational diabetes).
3. It has been suggested that the chronic conditions at hand – metabolic dysregulation, periodontal disease and diabetes – are linked by changes in the inflammatory state.

environmental and acquired risk factors. The destructive tissue changes observed in cases of periodontitis are the result of the host's inflammatory response to chronic oral infection.

**Diabetes**

There is evidence to suggest a bidirectional relationship between diabetes and periodontal disease. However, interpretation of these data is not straightforward due to differences in study designs. More research is needed to unequivocally establish a relationship between these conditions.

Large epidemiological studies have shown that individuals with diabetes are three-times more likely to develop periodontal disease than those without (Shlossman et al, 1990; Emrich et al, 1991) and the extent of glycaemic control may determine risk. The NHANES (US National Health and Nutrition Examination Survey) III study demonstrated that adults with poorly-controlled diabetes ( $HbA_{1c} >9\%$  [74.9 mmol/mol]) had a 2.9-fold increased risk of periodontitis than those without the condition, and that individuals with well-controlled diabetes had no significant increase in risk (Tsai et al, 2002). Furthermore, those with both conditions show an increased severity of periodontal destruction compared with those without diabetes (Mealey, 2006; Lakschevitz et al, 2011). These findings lead to suggestions that, when glycaemia is uncontrolled, diabetes can reduce the body's ability to appropriately respond to the microbial challenge presented by pathogenic oral bacteria, leading to a greater extent of periodontal destruction in this group (Oppermann et al, 2012).

Suggestive of a bidirectional relationship between glycaemic control and periodontal disease, the results of cross-sectional and prospective epidemiological studies have also found that periodontitis increases the risk of poor glycaemic control and is related to the development of complications in people with diabetes. Meta-analysis and observational evidence suggests that periodontitis may also be related to the development of type 2 diabetes (and possibly gestational diabetes [Borgnakke et al, 2013; Esteves et al, 2016]). The biological

plausibility of such a relationship is based on increasing evidence showing that inflammation is linked to insulin resistance and precedes the development of diabetes, and that inflammatory periodontal disease contributes to cumulative inflammatory burden (Wang et al, 2013). Thus, the level of glycaemic control may be a key factor in determining risk of periodontal disease, and vice versa. However, further large, longitudinal studies are required to validate these findings.

**Obesity**

The detrimental metabolic dysregulation commonly associated with obesity has been well described. Obesity contributes to insulin resistance through the elevation of circulating free fatty acids that inhibit glucose uptake, glycogen synthesis and glycolysis (Tunès et al, 2010). Beyond the association with dyslipidaemia, adipose tissue is recognised as an immune organ that secretes numerous immunomodulatory factors (Wisse, 2004). Thus, it has been suggested that the chronic conditions at hand – metabolic dysregulation, periodontal disease and diabetes – are linked by changes in the inflammatory state, and that a complex, bidirectional relationship exists, with each being a risk factor for further systemic complications (Mealey and Ocampo, 2007; Mealey and Rose, 2008; Dahiya et al, 2012; Levine, 2013; Palle et al, 2013). Levine (2013) has suggested that because periodontitis may stimulate inflammatory change in adipose tissue, the relationship between obesity, diabetes and periodontal disease may actually be a triangular self-generating cycle of morbidity.

**Towards better management: Improving glycaemic control and oral health**

It should be recognised that periodontal disease is preventable through adequate oral hygiene and associated professional care where indicated. The early detection and management of gingivitis can prevent the progression to periodontitis. The current gold standard for treating periodontal disease involves managing oral infection with the choice of treatment depending on the extent of disease. Periodontitis is usually managed with interventional, non-surgical therapies, together

with the use of antiseptic mouthwashes. Dental scaling (polishing) and root planing (also known as debridement) are most commonly used. Scaling involves removing plaque and tartar (hardened plaque) by scraping it from the tooth and around the gum line. Root planing – a more intensive type of cleaning – removes bacteria from the root of the tooth. In more extreme cases, periodontal surgery may be required to remove the affected tooth. Adjunctive systemic antibiotic therapy can also be used to further minimise infection.

### Impact of dental treatment

Accepting that a link between oral ill-health, poor glycaemic control and obesity-related metabolic dysregulation and increased pro-inflammatory markers exists, some authors have hypothesised that successful periodontal treatment that also reduces systemic inflammation may improve diabetes control through a reduction in systemic insulin resistance (Mealey and Rose, 2008).

A recent Cochrane review (Simpson et al, 2015) examined evidence relating to treatment of periodontal disease for glycaemic control in people with diabetes mellitus. The review showed that treatment of periodontal disease by scaling and root planing did improve glycaemic control with a mean reduction in HbA<sub>1c</sub> of 0.29% (3.2 mmol/mol) at 3–4 months. However, there was insufficient evidence to show maintenance of this benefit beyond 4 months. The authors concluded that ongoing professional periodontal treatment would be required to maintain clinical improvements beyond 6 months.

There was no evidence supporting any one periodontal therapy being more effective than others in improving glycaemic control in people with diabetes at this time. The authors also concluded that further research is required to determine whether adjunctive drug therapies should be used with periodontal treatment, to examine the long-term glycaemic benefits of ongoing periodontal treatment and to investigate the impact of such treatments on reducing periodontal inflammation in people with diabetes.

### Impact of improved diabetes management

Of all systemic conditions, diabetes provides the greatest risk factor for periodontitis and is associated with increased prevalence, severity and progression of disease (Lalla and Lamster, 2012). There is evidence to suggest that the level of diabetes control can have an influence on the response to periodontal treatment. The response to scaling and root planing in people with well-controlled diabetes appears similar to those without diabetes. Although many people with diabetes show improvement following treatment, individuals with poorer glycaemic control may have a more rapid recurrence of disease and a less favourable long-term prognosis (Mealey and Oates, 2006).

### Towards better health: Implications for practice

While the results of meta-analyses and population-based studies suggest that periodontal treatment is associated with improved glycaemic control, there is a paucity of trials of sufficient statistical power to substantiate this claim. Further larger, randomised trials are warranted in populations with similar baseline levels of periodontal disease and glycaemic control (Preshaw et al, 2012).

Though not yet fully substantiated, the evidence to-date has been convincing for many. A growing number of recognised health care bodies and institutions have seen fit to include oral care as an element of holistic care for the patient with long-term conditions, such as diabetes and obesity.

The American Diabetes Association's (2016) *Standards of Medical Care in Diabetes* highlights periodontal disease as a common comorbidity of diabetes. These guidelines emphasise dental practitioner involvement in a comprehensive diabetes evaluation, recommending that people with diabetes be referred for periodontal examination. Furthermore, the European Federation of Periodontology's (EFP; 2014) manifesto, *Perio and General Health* – following recommendations from the first joint EFP/American Academy of Periodontology (AAP) Working Group on Periodontitis and Systemic Health – is a call to action for dental professionals

### Page points

1. Results are inconclusive on whether periodontal treatment such as scaling and root planing are effective in treating periodontitis in people with diabetes.
2. Accepting that a link between oral ill-health, poor glycaemic control and obesity-related metabolic dysregulation and increased pro-inflammatory markers exists, managing one or more of these factors should have a positive impact on the others.
3. Although many people with diabetes show improvement following treatment, individuals with poorer glycaemic control may have a more rapid recurrence of disease and a less favourable long-term prognosis.

**Page points**

1. Dental professionals have the opportunity and the responsibility to assume an active role in the early identification, assessment and management of their patients who present with or are at risk of developing diabetes.
2. Although the association between diabetes and periodontal disease is long established, many people are unaware of the strength of this relationship.
3. Physicians should be aware of the common signs and symptoms of periodontal disease, including gingival bleeding, red/dark red discoloration and inflammation of gingiva, halitosis, an itching sensation in the gums, sensitivity to hot/cold temperatures, presence of toothache without caries and any mobility, extrusion or migration of teeth.

to engage in the screening of, and education for, people at risk of chronic disease, including diabetes (Chapple and Genco, 2013). The British Dental Association recently followed suit (Chapple and Wilson, 2014).

**Role of the dental professional**

Oral health can indicate signs of metabolic or systemic ill-health. A recent pilot study demonstrated that people at risk of developing type 2 diabetes could be identified in primary, community and secondary dental care settings (Preshaw, 2014), underlining the importance of the dental practitioner. Dental practitioners have the opportunity and the responsibility to assume an active role in the early identification, assessment and management of their patients who present with or are at risk of developing diabetes (Lalla and Lamster, 2012). They are well placed to provide counselling on the oral complications of overweight, obesity and diabetes; offer weight prevention and management advice and education; implement obesity and diabetes screening programmes (e.g. using weight-to-height ratio or waist circumference measurements to determine visceral adiposity and/or HbA<sub>1c</sub> as an indicator of glycaemic control), and importantly, to appropriately refer patients to primary care practitioners. Guidelines have been set out by the joint EFP/AAP for health professionals to use in diabetes practice and in dental practice (Chapple and Genco, 2013). The guidelines recommend:

- Informing people with diabetes of the increased risk of periodontal disease and that having periodontal disease may make glycaemic control more difficult, and informing individuals that they are at higher risk of diabetic complications.
- A thorough oral examination as part of the initial evaluation of people with type 1, type 2 and gestational diabetes.
- A periodontal examination for all newly diagnosed individuals with type 1 and type 2 diabetes (with annual review) as part of their ongoing management of diabetes.
- A prompt periodontal evaluation for people with diabetes presenting with overt signs and symptoms of periodontitis (i.e. loose teeth,

spacing or spreading of teeth and/or gingival abscesses).

- Dental rehabilitation to restore adequate mastication for proper nutrition in people with diabetes who have extensive tooth loss.
- Oral health education for all people with diabetes. People with diabetes are at increased risk of oral fungal infections and experience poorer wound healing. Practitioners should advise that other oral conditions (such as dry mouth and burning mouth) may occur.
- Annual oral screening from the age of 6–7 years for children and adolescents diagnosed with diabetes.

**Role of the healthcare professional**

Although the association between diabetes and periodontal disease is long established and periodontal disease has been described as the sixth complication of diabetes for over two decades (Loe, 1993), many patients are unaware of the strength of this relationship (Weinspach et al, 2013). The inclusion of dental practitioners as foundation members of the primary care multidisciplinary care team is currently not well established. Efforts should be made to increase awareness among primary care providers of the link between poor oral health and systemic disease – and vice versa. Alongside better awareness of the signs and symptoms of periodontal disease, primary care providers should proactively inquire when their patients last visited a dental practitioner, particularly in individuals with visceral adiposity and/or diabetes.

Physicians should be aware of the common signs and symptoms of periodontal disease, including gingival bleeding, red/dark red discoloration and inflammation of gingiva, halitosis, an itching sensation in the gums, sensitivity to hot/cold temperatures, presence of toothache without caries and any mobility, extrusion or migration of teeth. If the patient has any of the above, they should be referred to a dentist or a periodontist. Perhaps more importantly, physicians could further help their dental colleagues by providing the results of laboratory tests (e.g. HbA<sub>1c</sub>) to dentists on request, if not routinely (Dahiya et al, 2012).

## Conclusion

A number of healthcare bodies and institutions have recognised the utility of dental professionals in the multidisciplinary team to screen, and provide preventive education to, people at risk of chronic diseases, such as diabetes. Despite this, gaps between primary health care and dental care exists. Further engagement between the dental professional and primary care team could free-up time in the busy GP clinic, and provide more holistic care. ■

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