

Diabetes and periodontal disease: Relationship and management

Rajesh Chauhan

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, environmental and acquired risk factors. The destructive tissue changes observed in cases of periodontitis are

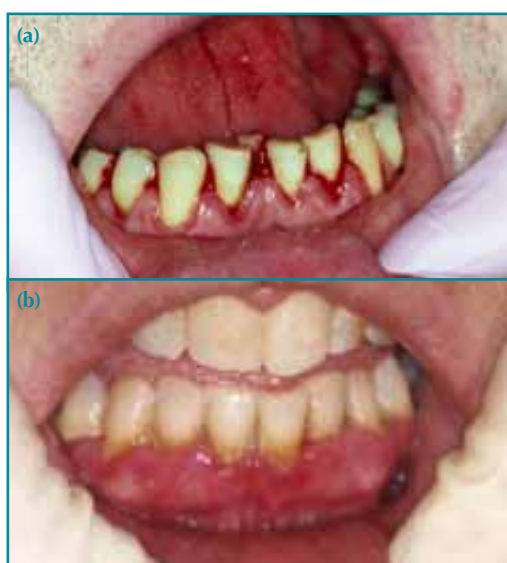


Figure 1. Examples of (a) gingivitis and (b) periodontitis. Note that the bleeding of the gums from gingivitis usually precedes receding gums and bone loss associated with periodontitis.

Citation: Chauhan R (2014) Diabetes and periodontal disease: Relationship and management. *Diabetes in Practice* 3: 49–53

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

Author

Rajesh Chauhan is Specialist in Oral Surgery, Lister Hospital, Stevenage and Queen Elizabeth II Hospital, Welwyn Garden City, Hertfordshire, and a General Dental Practitioner, Watton Place Clinic, Watton-at-Stone, Hertfordshire, and Dental Spokesman, National Obesity Forum, London.

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. It has been suggested that the chronic conditions at hand – metabolic dysregulation, periodontal disease and diabetes – are linked by changes in the inflammatory state.
3. Allowing 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.

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 in people with diabetes (Borgnakke 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 (Tunes 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).

Towards better management: Improving glycaemic control and oral health

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 be also be used to further minimise infection.

Impact of treatment

Allowing 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. Thus, 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).

Evidence confirms that scaling and root planing are effective in reducing periodontal disease; however, the benefit of adjunctive systemic antibiotic therapy has been debated (Gaikwad et al,

2013). A number of meta-analyses have reported that effective periodontal therapy can also improve glycaemic control – with reductions in HbA_{1c} of around 0.4% (4.4 mmol/mol) achieved (Janket et al, 2005; Darré et al, 2008; Teeuw et al, 2010; Gaikwad et al, 2013). These studies are particularly difficult to interpret as other glucose-lowering interventions may have confounded the results, or individuals simply improved their glycaemic control and periodontal health simultaneously. Stewart et al (2001) also report that some individuals demonstrate marked improvements in glycaemia after periodontal intervention, while others exhibit no change after similar regimens.

While several studies have reported reductions in HbA_{1c} following treatment for periodontal disease, there were a range of confounding factors (Preshaw et al, 2012; Chapple and Wilson, 2014). For example, one large meta-analysis that included nine controlled trials reported a 0.46% (5.0 mmol/mol) improvement in HbA_{1c} following periodontal therapy, but a number of problems in the study designs were noted (Darré et al, 2008).

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 (2013) *Standards of Medical Care in Diabetes* highlights periodontal disease as a common comorbidity of diabetes. These guidelines emphasize 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 Working Group on Periodontitis and Systemic Health – is a call to action for dental professionals to engage in the screening of, and education for, people at risk of chronic disease, including diabetes. 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 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_{1c} as an indicator of glycaemic control), and importantly, to appropriately refer patients to primary care practitioners.

Role of the healthcare professional

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 discolouration 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_{1c}) 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. ■

- American Diabetes Association (2013) Standards of medical care in diabetes – 2013. *Diabetes Care* **36**(Suppl 1): S11–66
- Borgnakke WS, Ylöstalo PV, Taylor GW, Genco RJ (2013) Effect of periodontal disease on diabetes: systematic review of epidemiologic observational evidence. *J Periodontol* **84**(4 Suppl): S135–52
- Chapple IL, Wilson NH (2014) Manifesto for a paradigm shift: periodontal health for a better life. *Br Dent J* **216**: 159–62
- Dahiya P, Kamal R, Gupta R (2012) Obesity, periodontal and general health: relationship and management. *Indian J Endocrinol Metab* **16**: 88–93
- Darré L, Verges JN, Gourdy P, Sixou M (2008) Efficacy of periodontal treatment on glycaemic control in diabetic patients: A meta-analysis of interventional studies. *Diabetes Metab* **34**: 497–506
- Emrich LJ, Shlossman M, Genco RJ (1991) Periodontal disease in non-insulin-dependent diabetes mellitus. *J Periodontol* **62**: 123–30
- European Federation of Periodontology (2014) *Perio and General Health*. EFP, Madrid. Available at: <http://bit.ly/SnDjJK> (accessed 30.05.14)
- Gaikwad SP, Guray AN, Shete AR, Desarda HM (2013) Effect of scaling and root planing combined with systemic doxycycline therapy on glycemic control in diabetes mellitus subjects with chronic generalized periodontitis: a clinical study. *J Periodontal Implant Sci* **43**: 79–86
- Graves D (2008) Cytokines that promote periodontal tissue destruction. *J Periodontol* **79**(8 Suppl): 1585S–1591S
- Janket SJ, Wightman A, Baird AE et al (2005) Does periodontal treatment improve glycemic control in diabetic patients? A meta-analysis of intervention studies. *J Dent Res* **84**: 1154–9
- Lakschevitz F, Aboodi G, Tenenbaum H, Glogauer M (2011) Diabetes and periodontal diabetes and periodontal diseases: interplay and links. *Curr Diabetes Rev* **7**: 433–9
- Levine RS (2013) Obesity, diabetes and periodontitis—a triangular relationship? *Br Dent J* **215**: 35–9
- Liu YC, Lerner UH, Teng YT (2010) Cytokine responses against periodontal infection: protective and destructive roles. *Periodontol* **52**: 163–206
- Mealey BL (2006) Periodontal disease and diabetes: a two-way street. *J Am Dent Assoc* **137**(Suppl): 265–315
- Mealey BL, Ocampo GL (2007) Diabetes mellitus and periodontal disease. *Periodontol* **44**: 127–53
- Mealey BL, Rose LF (2008) Diabetes mellitus and inflammatory periodontal diseases. *Curr Opin Endocrinol Diabetes Obes* **15**: 135–41
- Oppermann RV, Weidlich P, Muskopf ML (2012) Periodontal disease and systemic complications. *Braz Oral Res* **26**(Suppl 1): 39–47
- Palle AR, Reddy CM, Shankar BS et al (2013) Association between obesity and chronic periodontitis: a cross-sectional study. *J Contemp Dent Pract* **14**: 168–73
- Preshaw P (2014) Summary of: type 2 diabetes risk screening in dental practice settings: a pilot study. *Br Dent J* **216**: 416–7
- Preshaw PM, Alba AL, Herrera D et al (2012) Periodontitis and diabetes: a two-way relationship. *Diabetologia* **55**: 21–31
- Shlossman M, Knowler WC, Pettitt DJ, Genco RJ (1990) Type 2 diabetes mellitus and periodontal disease. *J Am Dent Assoc* **121**: 532–6
- Stewart JE, Wager KA, Friedlander AH, Zadeh HH (2001) The effect of periodontal treatment on glycemic control in patients with type 2 diabetes mellitus. *J Clin Periodontol* **28**: 306–10
- Teeuw WJ, Gerdes VEA, Loos BG (2010) Effect of periodontal treatment on glycemic control of diabetic patients: a systematic review and meta-analysis. *Diabetes Care* **33**: 421–7
- Tsai C, Hayes C, Taylor GW (2002) Glycemic control of type 2 diabetes and severe periodontal disease in the US adult population. *Community Dent Oral Epidemiol* **30**: 182–92
- Tunes SR, Foss-Freitas MC, Nogueira-Filho Gda R (2010) Impact of periodontitis on the diabetes-related inflammatory status. *J Can Dent Assoc* **76**: a35
- Wisse BE (2004) The inflammatory syndrome: the role of adipose tissue cytokines in metabolic disorders linked to obesity. *J Am Soc Nephrol* **15**: 2792–800
- World Health Organization (2013) *Obesity and Overweight. Fact Sheet Number 311*. WHO, Geneva. Available at: <http://bit.ly/18pCdAN> (accessed 23.04.14)

“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.”