

Diabetes mellitus and periodontal disease: education, collaboration and information sharing between doctors, dentists and patients

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Abstract

People living with diabetes (DM) are at higher risk of developing periodontal disease than those without diabetes. This observation was first recorded in 1928. It is now believed that the risk is 3-4 times greater than for people without DM, and more for smokers. However, many doctors are not aware of this.

DM and periodontal disease are bi-directionally linked, the one affecting the other and vice versa, although the mechanism is not fully understood. Periodontal disease has an adverse effect on glycaemic control. That improves when periodontitis is successfully treated.

Doctors should consider periodontal disease when their patients have persistently high glycated haemoglobin (HbA_{1c}) levels, and dentists should consider diabetes or pre-diabetes when they have patients with unstable periodontitis.

Doctors and dentists, and their teams, need to share results. This paper considers what that shared information should be. A system of red, amber and green for both medical and dental risks is proposed. Until there are reliable methods of information exchanges and a paradigm shift in inter-professional working, patients should obtain their medical and dental results and share them with their respective advisors.

Those patients who do not attend for dental care should be advised by their doctor about the potential benefits of dental screening for periodontitis.

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Introduction

The relationship between diabetes mellitus (DM) and periodontal disease (PD) is well established as a two-way positive bi-directional relationship.¹ The diseases are linked.² People with DM have a 3 to 4 times greater risk of developing PD than those without DM:³ for smokers the risk is 10 times greater, with a marked shift to the most serious stages of periodontitis when both smoking and DM are present.⁴

The individual disease risks for people with DM may be described.

Cardiopathy and arterial disease

Poor oral health is associated with atherosclerotic cardiovascular disease.⁵ This interaction raises cardiovascular morbidity fourfold and is associated with chronic infection, mediators from which may lead to the initiation of endothelial dysfunction.⁶

Nephropathy

People living with DM who are on haemodialysis are at greater risk of developing PD.⁷ With severe PD there is a 2.6 times greater risk of macroglobulinaemia and a 4.9 times greater risk for end stage renal disease (ESRD).⁸ Periodontal management may contribute to the prevention of renal disease: one study has shown that a low eGFR might be attributed to PD in Japanese middle-aged men.⁹ Patients could be screened for PD before acceptance onto dialysis programmes.⁹

Neuropathy

This is a microvascular complication;¹⁰ it is associated with xerostomia and can affect more than 40% of people with DM. As salivary flow reduces, the risk of developing caries increases due to a reduced buffering capacity. There is an inverse relationship between salivary flow and glycated haemoglobin (HbA_{1c}) levels that may be due to disturbances in glycaemic control.¹¹

Retinopathy

There are few studies of this complication together with PD. However, an increase in the severity of diabetic retinopathy is associated with the components of PD.¹²

The odds ratios of complications for people living with DM who have periodontitis compared to those people with DM but without PD are reported as:¹³

Retinopathy	2.8 – 8.7
Neuropathy	3.2 – 6.6
Cardiovascular	10.2 – 17.7
Mortality	2.3 – 8.5

Pathophysiology

While the pathophysiological mechanism of the relationship between the two diseases is still under investigation, there is a common pathogenesis between DM and PD involving an enhanced inflammatory response at both local and systemic levels.¹⁴ This is caused by the chronic effects of hyperglycaemia and the formation of advanced glycation end-products that promote the inflammatory response.¹⁵ Levels of cytokines,¹⁶ tissue necrosis factor¹⁵ and C-reactive protein¹⁴ are raised in both diseases. Interleukin 8 is also raised, contributing to potential cross-susceptibility.¹⁷ Polysaccharides in Gram-negative bacteria in mature dental plaque are known to stimulate the production of cytokines.¹⁸ Toxic products from these organisms initiate tissue breakdown and increased osteoclastic bone resorption in the periodontium. Osteoclastic activity also increases along with enhanced glycation levels and poor glycaemic control,¹⁹ thus stimulating further bone resorption and diminished bone formation in a vicious circle,¹⁵ and contributing to the enhanced levels of periodontitis and alveolar bone loss seen in people with DM.

Normal gingivae are pink, firm and stippled. When dental plaque is left, gingival inflammation ensues after 7 to 10 days,²⁰ and this is the precursor of periodontitis. PD is not a classical infection because no single causative organism has been identified and it does not conform to Koch's postulates. While multifactorial, it appears to be a chronic hypersensitivity reaction to inflammatory products predominantly from Gram-negative bacteria in dental plaque. It has been concluded that the chronic bacteriological challenge of PD is a persistent source of inflammatory mediators leading to endothelial dysfunction.^{6,21} It is the severity of hyperglycaemia that affects the periodontium most.³

These diseases affect each other. Moreover, there is some evidence that patients with periodontitis are at greater risk of developing gestational type 2 diabetes (TZDM)²² and pre-eclampsia.²³ PD has an adverse but modifiable effect on glycaemic control.²⁴ Periodontal therapy improves metabolic control so the overall management of diabetes may improve.^{25,26} These factors underline the need for screening people with PD for DM and vice versa.¹

Discussion

Periodontal disease has been described as the sixth complication of diabetes mellitus.²⁷ However, in one study only 5.7% of doctors asked questions about their patients' dental history.²⁸ People living with DM themselves are unaware of the link. While doctors may claim that dental problems are not their direct responsibility, who is going to advise those people with DM who do not have dental care about the increased risks they run, not only for dental problems but for their metabolic control?

More information is now available. In June 2022 the National Institute for Health and Care Excellence (NICE) added a recommendation that dental history be added to the annual checklist they

require doctors to carry out for their patients living with DM. In summary, the NICE recommendations to doctors caring for people with both type 1 and type 2 diabetes are that: they should advise patients that they are at greater risk of developing periodontal disease and that controlling periodontal disease can improve glycaemic control.²⁹

Helpfully, the DiabetesUK website section on dentistry has been updated to explain both periodontal and caries risks.

Recent papers have called for better inter-professional education and collaboration between doctors and dentists for their patients with DM.³⁰⁻³² Both parties need to be aware of the significance of the others' results and how relative risks may be quantified.

Suggested approach

For doctors

The gold standard for diabetic monitoring is the serum level of HbA_{1c}. The HbA_{1c} should be maintained below 6.5% (green band risk) or blood glucose below 7.8mmol/L. We suggest an amber band risk for 6.5 to 8.5% or blood glucose between 7.8 to 10.9mmol/L and a red band risk for greater than 8.5% or blood glucose greater than 10.9mmol/L in the first instance, although this could change with further research. Previously determined individualised targets will be more appropriate for some people with DM, particularly those who are frail or who lack awareness of hypoglycaemia.³³

For dentists

Various indices of periodontal health have been described. However, the measure of choice is the World Health Organization's Community Periodontal Index of Treatment Needs (CPITN),³⁴ called the Basic Periodontal Examination (BPE) in the UK. Dentists are required to examine patients using a specially designed dental pocket measuring probe and to record scores. There are six numbers, one in each of three sections comprising molars and premolars on each side, and incisors and canines as the central number. This score applies to both the mandible and the maxilla, making six scores in all. Each score is called a sextant. The severity of PD is graded from 0 to 4*. The maximum score in each sextant is recorded.

- 0 – Pockets less than 3.5mm. Periodontal health
- 1 – Pockets less than 3.5mm. Bleeding on probing (a sign of gingivitis and poor plaque control).
- 2 – Pockets less than 3.5mm. Plaque retentive factors and presence of calculus, indicating the need for professional mechanical plaque removal.
- 3 – Pockets of 3.5 to 5.5mm (early/moderate periodontal breakdown).
- 4 – Pockets of greater than 5.5 mm (severe periodontal breakdown).
- 4*- Furcation involvement bone loss between the roots of multi-rooted teeth (severe periodontal breakdown with an increased risk that teeth will require extraction).

Both the number and the * should be recorded if a root furcation is detected.

Dentists should share these results with their patients as a matter of routine, not least as a method of education and assistance in promoting better plaque control in those areas with high scores.

They could also include plaque and bleeding scores and pocket charts. However, such detail would not be required in the first instance for doctors and their teams to assess basic dental risks from periodontal screening.

The basis of understanding the risks that these scores give has been described in relation to nephropathy,⁹ and is recommended as the international standard to use as a simple to understand report for doctors about their patients with DM.³¹ From the sextant scores the single highest score is taken and classified:

0 or 1, low risk, green.
2 or 3, medium risk, amber.
4 or 4*, high risk, red.

Furcation involvements scored with an * increase the risk to the next higher level, for example 3* would raise the risk from amber to red.

This will provide an easily understood method of defining the relative risks for doctors, dentists and people living with DM.

Two consecutive scores should be used to establish trends.

Case report

Mrs D is aged 76 years, has lived all her life in the same English town, and has had type 1 DM (T1DM) for 25 years. She is monitored frequently by her doctor and has recently lost 2Kg in weight because her HbA_{1c} score was 8.6%, in the red zone for her doctor.

She has attended the same dentist for 40 years, has never had radiographs taken, and has been advised that her dental health is satisfactory despite BPE scores of 3 and the loss of mandibular central incisor teeth to periodontal abscesses (replaced with a removable acrylic partial denture). The classical 'gumstripper' will exacerbate her loss of periodontal attachment over time. Her dental risk is therefore amber and has been red.

Neither her doctor nor her dentist knows about each other's results.

In an ideal world her doctor should be asking whether her periodontal health is affecting glycaemic control,³¹ and her dentist whether her red zone HbA_{1c} scores are contributing to difficulties in controlling her periodontal disease.

This case reinforces the call for better sharing of results between the two professional groups. Dentists should be aware of diabetic periodontopathy.³⁵ However, the majority of doctors are not aware of the importance of periodontal disease for people with DM. This is no longer sustainable in relation to their patients. There is a need for a paradigm shift in training doctors about these risks, their thinking about risk factors for people with DM, result sharing and inter-professional co-operation.

The questions that need to be considered are how to inform doctors, dentists and their patients about the relationship between DM and PD, and especially those patients who have not attended for dental care for whatever reason. This is likely to be a long process although purchasers of healthcare could require these links to be made.

A simple questionnaire for doctors and their teams to determine

the dental health of their patients with DM could be a starting point.³¹ The questionnaire could ask whether their patients living with DM have regular dental care, and could record details of their dentist and their BPE scores. The objective would be to identify those patients who are at greatest risk with red zone scores for both diseases, as this group could have higher levels of other diabetic complications. This will require further research, especially in relation to treatment outcomes from collaborative care and methods to ensure effective inter-professional result sharing.

Conclusion

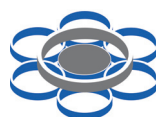
Fortunately, periodontitis is both a treatable and preventable disease, with good clinical outcomes when detected at an early stage. Prevention depends on daily efficient and effective control of plaque by patients.³⁶ In relation to other costs of care for the main diabetic complications, dental treatment is relatively cheap. Recent evidence has shown that periodontal treatment is cost-effective for people with T2DM, assuming that improvements in HbA_{1c} levels are maintained.³⁷

It follows that doctors and their teams who support patients living with DM will have to be taught about periodontitis. This could be through an addition to the undergraduate curriculum, postgraduate lectures and direct contact from dentists to doctors.³⁸

Dentists will have to change their medical history forms to show whether the diabetes is T1DM or T2DM, to show what the HbA_{1c} results are and to understand their significance.

Pending further research and the development of inter-professional links, patients could take charge of their own health by recording their HbA_{1c} results from their doctor and, if they have dental care, their BPE scores. They could then find their relative risks using the traffic light method described above and show both parties the results.

A pro forma has been designed to simplify the objective of information sharing of relative risks between the three parties (doctors, dentists, and people living with DM) because the traffic light system is readily understandable by all.³⁸ It should be regarded as a starting point in the process of helping those living with DM to be



Key messages

- First described in 1928, periodontal disease has been a forgotten complication of diabetes mellitus
- In 2022 NICE changed medical practice. Doctors are now asked to inform their patients living with DM that they are at greater risk of developing PD and that its treatment can improve glycaemic control
- A traffic light method of scoring both medical and dental risks has been developed to enable result sharing between doctors, dentists and their patients
- Doctors, dentists and their teams need to work together in the future care of these patients.

more aware of their risks of complications and making them more involved in their care.

However, it will require doctors, dentists and their teams to make their results readily available for their patients as a matter of routine. For dentists who are not routinely sharing their BPE results this will represent a significant change in their working practices.

Meanwhile, it follows that multi-professional teams should work together and involve their patients to facilitate and improve diabetes management and clinical outcomes.

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Permission Mrs D has given written permission for the publication of her case résumé.

References

- Stöhr J. Bidirectional association between periodontal disease and diabetes mellitus: a systematic review with meta-analysis of cohort studies. *Sci Rep* 2021;**11**:13686. <https://doi.org/10.1038/s41598-021-93062-6>
- Tsaic C, Hayes C, Taylor GW. Glycaemic control of type II diabetes and severe periodontal disease in the US adult population. *Community Dent Oral Epidemiol* 2002;**30**:182-92. <https://doi.org/10.1034/j.1600-0528.2002.300304.x>
- Genco RJ, Borgnakke WS. Risk factors for periodontal disease. *Periodontol* 2000 2013;**62**:59-94. <https://doi.org/10.1111/j.1600-0757.2012.00457.x>
- Battancs E, Gheorghita D, Nyiraty S, et al. Periodontal disease in diabetes mellitus: a case-control study in smokers and non-smokers. *Diabetes Ther* 2020;**11**:2715-28. <https://doi.org/10.1007/s13300-020-0093-8> Epub 2020 Sep 25
- Gianos E, Jackson EA, Tejpal A, et al. Oral health and atherosclerotic cardiovascular disease: A review. *Am J Prev Cardiol* 2021;**7**:100179. <https://doi.org/10.1016/j.ajpc.2021.100179>
- Khumaedi AI, Purnamasari D, Wijaya P, Soerono Y. The relationship of diabetes, periodontitis and cardiovascular disease. *Diabetes Metab Syndr* 2019;**13**:1675-8. <https://doi.org/10.1016/j.dsx.2019.03.023>
- Mahajan S, Bhaskar N, Kaur RK, Jain A. A comparison of oral health status in diabetic and non-diabetic patients receiving haemodialysis – a systematic review and meta-analysis. *Diabetes Metab Syndr* 2021;**15**:102256. <https://doi.org/10.1016/j.dsx.2021.102256>
- Preshaw PM, Alba AL, Herrera D, et al. Periodontitis and diabetes: a two-way relationship. *Diabetologia* 2012;**55**:21-31. <https://doi.org/10.1007/s00125-011-2342> Epub 2011 Nov 6.
- Yoshioka M, Okamoto Y, Murata M, et al. Association between oral health status and diabetic nephropathy-related indices in Japanese middle-aged men. *J Diabetes Res* 2020;**2020**:Article ID 4042129. <https://doi.org/10.1155/2020/4042129>
- Borgnakke WS, Anderson PF, Shannon C, Jivanescu A. Is there a relationship between oral health and diabetic neuropathy? *Curr Diab Rep* 2015;**11**:93. <https://doi.org/10.1007/s11892-015-0673-7>
- Moore PA, Weyant RJ, Mongelluzzo MB, et al. Type 1 diabetes, xerostomia and salivary flow rates. *Oral Medicine* 2001;**92**:281-91. <https://doi.org/10.1067/moe.2001.117815>
- Tandon A, Kamath YS, Gopalkrishna P, et al. The association between diabetic retinopathy and periodontal disease. *Saudi J Ophthalmol* 2021;**34**:167-70. <https://doi.org/10.4103/1319-4534.310412>
- Nguyen ATM, Akhtar R, Garde S, et al. The association of periodontal disease with the complications of diabetes mellitus. A systematic review. *Diabetes Res Clin Prac* 2020;**165**:108244. <https://doi.org/10.1016/j.diabres.2020.108244>
- Southerland JH, Taylor GW, Offenbacher S. Diabetes and periodontal infection: making the connection. *Clinical Diabetes* 2009;**23**:171. <https://doi.org/10.2337/diaclin.23.4.171>
- Liu R, Bal HS, Desta T, et al. Tumor necrosis factor-alpha mediates diabetes-enhanced apoptosis of matrix-producing cells and impairs diabetic healing. *Am J Pathol* 2006;**168**:757-64. <https://doi.org/10.2353/ajpath.2006.050907>
- Johnson DR, O'Connor JC, Satpathy A, Freund GG. Cytokines in type II diabetes. *Vitam Horm* 2006;**74**:405-41. [https://doi.org/10.1016/S0083-6729\(06\)74017-1](https://doi.org/10.1016/S0083-6729(06)74017-1)
- Lappin DF, Robertson D, Hodge P, et al. The influence of glycated haemoglobin on the cross-susceptibility between type I diabetes and periodontal disease. *J Periodont* 2015;**86**:1249. <https://doi.org/10.1902/jop.2015.150149>
- Wu YY, Xia E, Graves DT. Diabetes mellitus related bone metabolism and periodontal disease. *Int J Oral Sci* 2015;**7**:63-72. <https://doi.org/10.1038/ijos.2015.2>
- Krakauer JC, McKenna MJ, Buderer NF, et al. Bone loss and bone turnover in diabetes. *Diabetes* 1995;**44**:775-82. <https://doi.org/10.2337/diab.44.7.775>
- Löe H, Theilade E, Jensen SB. Experimental gingivitis in man. *Periodontol* 1965;**36**:177-87. <https://doi.org/10.1092/jop.1965.36.3.177>
- Cekici A, Kantarci A, Hasturk H, Van Dyke TE. Inflammatory and immune pathways in the pathogenesis of periodontal disease. *Periodontol* 2000 2014;**64**:57-80. <https://doi.org/10.1111/prd.12002>
- Genco RJ, Graziani F, Hasturk H. Effects of periodontal disease on glycaemic control, complications and incidence of diabetes mellitus. *Periodontol* 2000 2020;**83**:59-65. <https://doi.org/10.1111/prd.12271>
- Kumar A, Sharma DS, Verma M, et al. Association between periodontal disease and gestational diabetes mellitus: a prospective cohort study. *J Clin Periodontol* 2018;**45**:920-31. <https://doi.org/10.1111/jcpe.12902>
- Taylor GW. Bidirectional interrelationships between diabetes and periodontal disease: an epidemiological perspective. *Ann Periodontol* 2001;**1**:99-112. <https://doi.org/10.1902/annals.2001.6.1.99>
- Costa KI, Taboza ZA, Angelino GB, Siveira V, et al. Influence of periodontal disease on changes of glycated haemoglobin levels in patients with type 2 diabetes mellitus: a retrospective cohort study. *J Periodontol* 2017;**88**:17-25. <https://doi.org/10.1092/jop.2016.160140>
- Wang TF, Jen IA, Chou C, Lei P. Effects of periodontal therapy on metabolic control in patients with type 2 diabetes and periodontal disease: a meta-analysis. *Medicine (Baltimore)* 2014;**93**:e292. <https://doi.org/10.1097/MD000000000000292>
- Löe H. Periodontal disease. The sixth complication of diabetes mellitus. *Diabetes Care* 1999;**16**:329-34.
- Tse SY. Diabetes mellitus and periodontal disease: awareness and practice among doctors working in public general outpatient clinics in Kowloon West Cluster of Hong Kong. *BMC Fam Prac* 2028;**19**:199. <https://doi.org/10.1186/s12875-018-0887-2>
- NICE.org.uk/guidance/NG17/chapter/recommendations NICE (2015). *Recommendations | Type 1 diabetes in adults: diagnosis and management | Guidance | NICE*. [online] www.nice.org.uk. Available at: <https://www.nice.org.uk/guidance/ng17/chapter/Recommendations>
- NICE.org.uk/guidance/NG28/chapter/recommendations NICE (2015). *Recommendations | Type 2 Diabetes in adults: Management | Guidance | NICE*. [online] www.nice.org.uk. Available at: <https://www.nice.org.uk/guidance/ng28/chapter/Recommendations>
- Siddiqi A, Zafar S, Sharma A, Quaranta A. Diabetes mellitus and periodontal disease. The call for interprofessional education and interprofessional collaborative care. A systematic review of the literature. *J Interprof Care* 2020;**10**:1. <https://doi.org/10.1080/13561820.2020.1825354>
- Turner C. Diabetes mellitus and dental health: a review. *Geriatric Med J*, 16 November 2021. <https://www.gmjjournal.co.uk/diabetes-and-dental-health-a-review>.
- King R, Chasma F. Diabetes and periodontal disease. *Faculty Dent Journal* 2022;**13**:78-81. <https://doi.org/10.1308/rcsfdj.2022.18>
- Strain WD, Down S, Brown P, Puttanna A, Sinclair A. Diabetes and frailty: an expert consensus statement on the management of older adults with type 2 diabetes. *Diabetes Ther* 2021;**12**:1227-47. <https://doi.org/10.1007/s13300-021-01035-9>
- Barnes D. CPITN – a WHO initiative. *Int Dent J* 1994;**44**:523-5. Available at: <https://pubmed.ncbi.nlm.nih.gov/7836006/>
- Williams J. Diabetic periodontoclasia. *J Amer Dent Assoc* 1928;**15**:523-9.
- Turner CH. Implant maintenance. *The Dentist* 2011, 62.
- Simpson TC, Clarkson JE, Worthington HV, et al. Treatment of periodontitis for glycaemic control in people with diabetes mellitus. *Cochrane Database of Systematic Reviews* 2022 CD004714. <https://doi.org/10.1002/14651858.CD004714.pub4>
- Turner C. Diabetes mellitus and periodontal disease; the profession's choices. *Brit Dent J* 2022;**233**:537-8. <https://doi.org/10.1038/s41415-022-5029-5>