



REVIEW

Diabetes mellitus and periodontal disease: some perspectives in care. A Review

Diabetes mellitus y enfermedad periodontal: algunas perspectivas en la atención. Una revisión

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ABSTRACT

While the incidence of diabetes mellitus varies between populations and countries type 2 is becoming an increasing burden for health care professionals.

First recorded in 1928, people living with diabetes mellitus (DM) are at a 3-4 times higher risk of developing periodontal disease (PD) than non-diabetics; for those who smoke this risk is up to 10 times. However, many doctors are not aware of this.

DM and PD are bidirectionally linked, the one affecting the other and vice versa, although the mechanism is not fully understood and may be linked to chronic infection. PD has an adverse effect on glycaemic control. That improves when periodontitis is successfully controlled.

Doctors should consider PD when their patients have persistently high glycated haemoglobin (HbA1c) levels, and dentists should consider diabetes or pre-diabetes when they have patients with unstable or progressive periodontitis.

Wherever possible, for optimum health outcomes doctors and dentists and their teams need to share results and work together. A traffic light system of red, amber and green for both medical and dental risks is proposed, and a *pro forma* designed, so that diabetics themselves can share their own results with their professional advisors.

Dentists need to find ways to teach their medical colleagues about the basics of PD, update their medical records, and understand more about medical risks. More research is required.

Keywords: Diabetes; Periodontitis; Risk Assessment; Interprofessional Collaboration.

RESUMEN

Aunque la incidencia de la diabetes mellitus varía según las poblaciones y los países, la de tipo 2 se está convirtiendo en una carga cada vez mayor para los profesionales sanitarios.

Registrada por primera vez en 1928, las personas con diabetes mellitus (DM) tienen un riesgo entre 3 y 4 veces mayor de desarrollar enfermedad periodontal (EP) que los no diabéticos; en el caso de los fumadores, este riesgo es hasta 10 veces mayor. Sin embargo, muchos médicos no son conscientes de ello.

La DM y la EP están vinculadas bidireccionalmente, ya que una afecta a la otra y viceversa, aunque el mecanismo no se conoce del todo y puede estar relacionado con una infección crónica. La EP tiene un efecto adverso sobre el control glucémico. Esto mejora cuando la periodontitis se controla con éxito.

Los médicos deberían plantearse la EP cuando sus pacientes tengan niveles de hemoglobina glucosilada (HbA1c) persistentemente altos, y los dentistas deberían plantearse la diabetes o la prediabetes cuando tengan pacientes con periodontitis inestable o progresiva.

Siempre que sea posible, para obtener unos resultados sanitarios óptimos, los médicos, los dentistas y sus equipos deben compartir los resultados y trabajar juntos. Se propone un sistema de semáforo de rojo, ámbar y verde para los riesgos médicos y dentales, y se diseña un *pro forma*, para que los propios diabéticos puedan compartir sus propios resultados con sus asesores profesionales.

Los dentistas tienen que encontrar la forma de enseñar a sus colegas médicos los aspectos básicos de la EP, actualizar sus historiales médicos y comprender mejor los riesgos médicos. Se necesita más investigación.

Palabras clave: Diabetes; Periodontitis; Evaluación De Riesgos; Colaboración Interprofesional.

INTRODUCTION

First described in 1928,⁽¹⁾ the relationship between diabetes mellitus (DM) and periodontal disease (PD) is well established as a two-way positive bi-directional interaction.⁽²⁾ The diseases are linked.⁽³⁾ People with DM have a 3 to 4 times greater risk of developing PD than non-diabetics.⁽⁴⁾ 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.⁽⁵⁾

Pathophysiology

The pathophysiological mechanism of the relationship between the two diseases is still under investigation. There is a common pathogenesis between diabetes mellitus and PD involving an enhanced inflammatory response at both local and systemic levels.⁽⁶⁾ This is caused by the chronic effects of hyperglycaemia and the formation of advanced glycation end-products that promote the inflammatory response.⁽⁷⁾ Levels of cytokines,⁽⁸⁾ tissue necrosis factor⁽⁷⁾ and C-reactive protein⁽⁶⁾ are raised in both diseases. Interleukin 8 is also raised contributing to potential cross-susceptibility.⁽⁹⁾ Polysaccharides in Gram-negative bacteria in mature dental plaque are known to stimulate the production of cytokines.⁽¹⁰⁾ Toxic products from these organisms initiate tissue breakdown and increased osteoclastic bone resorption in the periodontium. Osteoclastic activity also increases with enhanced glycation levels and poor glycaemic control,⁽¹¹⁾ thus stimulating further bone resorption and diminished bone formation⁽⁷⁾ in a vicious circle and contributing to the enhanced levels of periodontitis and alveolar bone loss seen in people with diabetes.

When dental plaque is left, after 7 to 10 days⁽¹¹⁾ gingival inflammation ensues and this is the precursor of periodontitis. PD is not a classical infection. 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.^(12,13) It is the severity of hyperglycaemia that affects the periodontium most.⁽⁴⁾

These diseases affect each other. Moreover, there is some evidence that patients with periodontitis are at greater risk of developing type 2 diabetes⁽¹⁴⁾ and pre-eclampsia.⁽¹⁵⁾ PD has an adverse but modifiable effect on glycaemic control.⁽¹⁶⁾ Periodontal therapy improves metabolic control so the overall management of diabetes may improve.^(17,18) These factors underline the need for screening people with periodontal disease for diabetes mellitus and *vice versa*.⁽²⁾

Medical risks for people living with Diabetes Mellitus

There are five well-recognised individual medical disease risks for diabetic patients. Some patients will have more than one complication.

Cardiopathy and Arterial Disease

Poor oral health is associated with atherosclerotic cardiovascular disease⁽¹⁹⁾ This interaction raises cardiovascular morbidity fourfold and is associated with chronic infection, mediators from which may lead to the initiation of endothelial dysfunction.⁽¹³⁾

Nephropathy

People living with diabetes on haemodialysis are at greater risk of developing PD.⁽²⁰⁾ For severe PD there is a 2,6 times greater risk of macroglobulinaemia and 4,9 times for end stage renal disease (ESRD).⁽²¹⁾ Periodontal management may contribute to the prevention of renal disease because one study has shown that a low eGFR might be attributed to PD in Japanese middle-aged men.⁽²²⁾ Before acceptance on dialysis programmes, patients could be screened for PD.⁽²²⁾

Neuropathy

This is a microvascular complication⁽²³⁾ and is associated with xerostomia and can affect over 40 per cent of

diabetics. 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 HbA1c levels that may be due to disturbances in glycaemic control.⁽²⁴⁾

Retinopathy

There are few studies of this complication together with PD using different criteria.⁽²⁵⁾ However, an increase in the severity of diabetic retinopathy is associated with the components of PD though more research is required.^(26,27)

The odds ratios for people living with diabetes with periodontitis compared to those people with diabetes but without PD are reported as:⁽²⁸⁾

Retinopathy	2,8 - 8,7
Neuropathy	3,2 - 6,6
Cardiovascular	10,2 - 17,7
Mortality	2,3 - 8,5

Periodontal disease is now regarded as the sixth complication of diabetes mellitus.⁽²⁹⁾ In one study only 5,7 per cent of doctors asked questions about their patient's dental history.⁽³⁰⁾ People living with diabetes themselves can be unaware of the link. In the UK in 2022 the National Institute for Clinical Excellence (NICE) added a recommendation for dental history be added to be the annual check list they require doctors to carry out for their type 1 and type 2 diabetic patients. In summary, they should advise patients that they are at greater risk of developing periodontal disease and that controlling periodontal disease can improve glycaemic control.⁽³¹⁾

Recent papers have called for better inter-professional education and collaboration between doctors and dentist for their patients with diabetes.^(32,33) It follows that both parties need to be aware of the significance of the others results and how relative risks may be quantified.

Diabetes Medication

Drugs treat diabetes mellitus by altering the glucose level in the blood. With the exception of insulin, all are orally administered hypoglycaemic or anti-hyperglycaemic agents.

Type 1 DM is a disease caused by a lack of insulin which must be injected subcutaneously or by an insulin pump. The insulin can be fast or long-acting. Doses have to be carefully matched to individual needs.

Type 2 DM is a disease of insulin resistance by cells. Treatments include agents that (a) increase the amount of insulin secreted by the pancreas, (b) increase the sensitivity of target organs to insulin, (c) decrease the rate at which glucose is absorbed from the gastrointestinal tract, and (d) increase the loss of glucose through urination. The principal drug groups are:

DRUG CLASS	MODE OF ACTION
Sulphonylureas	Stimulate insulin release by pancreatic beta cells
Metformin	Acts on the liver to reduce gluconeogenesis
Alpha-glucoside inhibitors	Inhibit carbohydrate digestion in the small intestine
Thiazolidinediones	Reduce insulin resistance
GLP-1 agonists	Mimic the effects of a natural appetite suppressing hormone

For some patients, insulin injections are also prescribed.

Defining risk factors for doctors

The gold standard for diabetic monitoring is the serum level of glycated haemoglobin which is a 2-to-3-month, retrospective measure, the HbA1c. For convenience and to highlight relative risks, a traffic light method of scoring has been developed.^(34,35) When recorded as percentage levels HbA1c should be maintained below 6,5 per cent (green), an amber band risk for 6,5 to 8,5 per cent, and a red band for greater than 8,5 per cent in the first instance although this could change with further research. More recently the values have been expressed as either mmol/mol or mmol/litre (table 1). Individual countries will need to standardise which measure they wish to adopt.

	< 6,5	6,5 - 8,5	8,5>
Percentage	< 6,5	6,5 - 8,5	8,5>
mmol/mol	< 48	48 - 69	69 >
mmol/L	< 7,8	7,8 - 10,9	10,9 >
Risk factor	Low, green	Moderate, amber	High, red

One recent study in the UK highlighted the problems that are caused by using more than one measuring method for HbA1c.⁽³⁶⁾ However, previously determined individualised targets could be more appropriate for some people with diabetes particularly those who are frail or lack awareness of hypoglycaemia.⁽³⁷⁾

Defining risks factors for dentists

Various indices of periodontal health have been described. However, the measure of choice is the World Health Organisation’s Community Periodontal Index of Treatment Needs (CPITN)⁽³⁸⁾ to create a score for each sextant from 0 to 4*. The maximum score in each sextant is recorded. Because the exact definitions vary from country to country, the original definitions have been used.

- 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*- Root furcation involvement or severe periodontal breakdown with an increased risk that teeth will require extraction.
- with the proviso that 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. More detail such as plaque and bleeding scores and pocket charts 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 and put forward as the international standard to use as a simple to understand report for doctors about their patients with diabetes.^(34,39) However, category 2, calculus covers both supra- and subgingival types, the latter of which are more damaging and giving a higher risk. For example, a patient with small quantities of supra-gingival calculus lingual to the lower incisors would score 2 and be placed in a higher risk group. The author has advised that score 2 should be divided into 2 - supra and 2* sub-gingival calculus scores.⁽³⁴⁾ With this in mind, from the sextant scores, the single highest score is taken and classified (table 2).

Highest sextant score	0 or 1 or 2	2* or 3	4 or 4*
Risk factor	Low, green	Moderate, amber	High, red
Note: Except that 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 both doctors, dentists and people living with diabetes.

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 type I DM (T1DM) for 25 years. She is monitored by her doctor and has just lost 2 Kg in weight because her HbA1c score is 8,6 per cent, in the red zone for her doctor.

She has attended the same dentist for forty years and been advised that her dental health is satisfactory despite BPE scores of 3 and the loss of mandibular central incisor teeth and maxillary molars to periodontal abscesses, replaced with a removable acrylic partial denture. Her dental risk is therefore amber and has been red.

Neither her doctor nor dentist know about each other’s results. In an ideal world her doctor should be asking if her periodontal health is affecting glycaemic control,⁽³¹⁾ and her dentist whether her red zone HbA1c scores are contributing to difficulties in controlling her periodontal disease. Since using the correct size interdental brush for each space her gingivae have stopped bleeding and her HbA1c is now in the green zone.

This classical case reinforces the call for better sharing of results between the two professional groups. Dentists should be aware of diabetic periodontopathy.⁽¹⁾ However, doctors, may not be aware of the importance of periodontal disease for diabetics. In relation to their diabetic patients this is no longer sustainable. There is a need for a paradigm shift in training doctors about these risks, their thinking about diabetic’s risk factors, result sharing, and inter-professional co-operation.

Dentist will need to find ways to teach doctors and their teams about the basics of PD.⁽³⁹⁾

It is suggested that individual dentists should share the above risk information for their DM patients with his/her doctor as a matter of routine.

DISCUSSION

Periodontitis has been recognised as the sixth complication of PD⁽²⁷⁾ Many doctors need help to identify these relative risks, what referrals to dentists would be beneficial to their DM patients, or how to help those patients who do not have dental care or professional co-operation. However, it is a start on what could be a long road to improve the overall care of people living with DM. A simple questionnaire for doctors and their teams to determine the dental health of their diabetic patients could be a starting point⁽³³⁾ asking if their patients have regular dental care, recording who is their dentist and their CPITN scores with the objective of identifying 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, as well as methods to ensure effective inter-professional result sharing dependent upon doctors being willing to listen to and accept dental opinion.

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.⁽⁴¹⁾ 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 Type 2 diabetes assuming improvements in HbA1c levels are maintained.⁽⁴²⁾

It follows that doctors and their teams who support patients living with diabetes will have to be taught about periodontitis.⁽³⁹⁾

Dentists will have to change their medical history forms to show whether the diabetes is Type 1 or Type 2, what the HbA1c results are and understand their significance as determinants of risk together with that of their patient’s therapeutic regimes. They should ask questions about glycaemic stability and whether their patient has had hospitalisation for hypo- or hyper-glycaemic episodes.⁽⁴³⁾

Pending further research and the development of inter-professional links, patients could take charge of their own health by recording their HbA1c results from their doctor and, if they have dental care, their BPE scores from which they could find both 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 diabetes because the traffic light system is readily understandable by all,^(34,39) (table 3) and can be freely copied.

Table 3. Pro forma designed

MY DIABETES RESULTS FOR 20..... NAME.....DOB..... Doctors - HbA1c, this should be below 6,5 % Risk Factor: less than 6,5 % low; 6,5-8,5 %, medium; 8,5 % or more high, or Less than 48mmol/mol,low;48-70mmol/mol,medium; 70mmol/mol or more,high Less than 7,8mmol/L, low; 7,8-10,9 mmol/L, medium: more than 10,9 mmol/L high Date HbA1c..... Risk level..... Previous results Date HbA1c..... Risk level..... Dentists: The Basic periodontal examination Date..... Highest score.....	
Risk Factor 0,1,2 low; 2*-3 medium; 4 or 4* high Previous results Date..... Highest score.....	
Risk Factor 0,1,2 low; 2*-3 medium; 4 or 4* high Notes. These numbers range from 0 to 4*. The maximum score in each sextant is recorded. 0 - no periodontal problems. 1 - bleeding on probing (a sign of gingivitis and poor plaque control). 2 - Supragingival calculus (indicating the need for scaling and root planing) 2*- Subgingival calculus (indicating need for scaling and ultrasonic root planing) 3 - Pockets of 3,5 to 5,5mm (that is early periodontal breakdown). 4 - Pockets of 5,5 to 8,5mm (that is moderately severe periodontal breakdown). 4*- Pockets greater than 8,5mm (that is severe periodontal breakdown with an increased risk that teeth will require extraction). © Dr C Turner, 2022, 2024. Reference: Brit dent J 233: 1, 2022.	

This method of assessment should be regarded as a starting point in the process in helping those living with diabetes to be more aware of their risks of complications and making them more involved in their own care. However, it will require both 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 CPITN results this will represent a significant change in their working practices.

Meanwhile, it follows that, wherever possible, multi-professional teams should work together and involve their patients to facilitate and improve diabetes management and clinical outcomes in a rapidly changing environment. While insulin will remain the therapy for type 1 diabetics, continuous blood sugar monitoring and insulin pump techniques are becoming routine and stem cell therapy is being investigated. For type 2 diabetics drug therapy and weight loss are the starting points in medical care.

CONCLUSIONS

Periodontitis is a significant factor for people living with DM that has been overlooked by doctors. Dentists should take the lead by informing them about the periodontal status of their patients as a first step in information and care sharing. Diabetics themselves should be used to keep both their medical and dental records and share them with their respective professional advisors.

Dentists should share the CPITN scores with their patients as a matter of routine and with their diabetic patient's doctor and update their medical history forms.

CPITN score 2, calculus, should be amended to 2 for supra- and 2* for sub-gingival presentation to more accurately define risks to health.

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