PERIODONTAL DISEASE AND DIABETES MELLITUS – A RISKY RELATIONSHIP

Dr Chris Turner MSc, BDS, MDS, FDSRCS is a retired specialist in restorative dentistry, who has been actively campaigning for the official recognition of dentists as part of the essential primary care team for people living with diabetes and for doctors and dentists to work together.

He reviews the latest research about the two-way links between periodontal disease (PD) and diabetes mellitus (DM) and how each disease affects the other.

Overview

First described in 1928[1], people with diabetes are at three to four times greater risk of developing PD. This rises to 10 times for smokers[2]. The exact link between PD and DM and the mechanism of this important inter-relation is still unclear[3]. There is common pathogenesis involving an enhanced inflammatory response at both local and systemic levels[3].

This is caused by the chronic effects of hyperglycaemia and the formation of advanced glycaemic products that promote the inflammatory response. Levels of cytokines[4], tissue necrosis factor[5] and C-reactive protein[6] are raised in both diseases. PD has an adverse but modifiable effect on glycaemic control[7]. The good news is that periodontal therapy improves metabolic control, so that the overall management of DM may improve[8,9]. Dental care is an important component of diabetes management for patients.

This was recognised in June 2022 by the National Institute for Health and Clinical Excellence. Periodontal health has now been included in the annual doctor's checklist for patients living with diabetes to advise adults with both type 1 and type 2 diabetes[10,11] at their annual review:

- They will be at higher risk of periodontitis.
- If they get periodontitis, managing it can improve their blood sugar control and can reduce their risk of hyperglycaemia.
- They should have regular oral health reviews at a frequency based on their oral health needs.

In the longer term, this will enable doctors and dentists and their teams to work together and should provide important benefits for all those living with diabetes. In the immediate future it raises further questions.

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What is periodontal disease?

PD is a common disease. It is an inflammation of both the soft and bony tissues around the teeth. The gingivae become red and swollen, the pocket of soft tissue around the neck of the tooth increases in depth and calculus begins to form below the gum margin. Bone resorbs and spaces appear below the gum. Plaque is retained and in the absence of dental treatment, the process can continue until teeth become loose in their sockets and may require extraction.

While multifactorial, PD is not a typical bacterial infection and does not meet Koch's postulates. No single organism has ever been identified as the cause. It is a hypersensitive reaction to toxic products produced by Gram-negative bacteria in mature plaque. This chronic bacterial challenge is a persistent source of inflammatory mediators leading to endothelial dysfunction[12]. It is the severity of the hyperglycaemia that affects the periodontium most[13].

When plaque is not removed for 7-10 days, gingival inflammations follow and this leads to PD[14]. The disease can progress due to these inadequate brushing techniques. This leads to bone loss and gingival recession over time, known as adult periodontitis.

About 15% of the population have a more aggressive type, rapidly progressive periodontitis that may have a genetic element, and as its name suggests, leads to faster breakdown of the periodontium and earlier tooth loss. Inflamed gingivae form sub-gingival calculus that is either green or black in colour due to blood breakdown products. Unless this is professionally removed by ultrasonic scaling, it migrates down the root over time, enhancing bone loss. In contrast, normal gingivae are pink, firm and stippled. Bleeding on brushing is never normal.

The toxic products from dental plaque include C-reactive protein[6], tissue necrosis factor[7] and cytokines[8] stimulate osteoclastic resorption of the alveolar processes, the bone supporting the teeth. High blood sugar levels also stimulate osteoclastic activity and more bone resorption[15] thus creating a vicious circle. People living with diabetes have reduced healing capacity. This explains the clinical findings of the increased risk of PD in people with diabetes. Additionally, there is some evidence that patients with PD are at risk of developing type 2 diabetes[7] and pre-eclampsia[16].

Periodontal risks for people living with diabetes

PD is the sixth complication of DM and affects its outcome[17].

In summary from the limited studies that have been undertaken, there are a few things to take into consideration.

Cardiac and arterial disease – Poor oral health is associated with atherosclerotic cardiovascular disease raising morbidity fourfold and is associated with chronic infection[18]. Mediators from this chronic infection may lead to endothelial dysfunction[12].

Nephropathy – About 40% of haemodialysis patients are living with diabetes and are at greater risk of developing PD[19]. For patients with severe PD, there is a 2.6 times greater risk of developing kidney problems and end-stage renal disease[20]. Periodontal management can contribute to the prevention of severe renal disease[21]. People with diabetes could be screened for PD before acceptance onto these programmes[21].

Neuropathy – This is a microvascular complication associated with xerostomia or dry mouth, that can affect 40% of people living with diabetes and may be overlooked[22]. As salivary flow reduces, the risk of developing caries increases due to a reduced buffering capacity and raised salivary sugar levels. There is an inverse relationship between salivary flow and HbA1c levels that may be due to disturbances in glycaemic control[23].

Retinopathy – An increase in the severity of diabetic retinopathy has been associated with the components of PD[24].

Medical risks important for dentists and people living with diabetes

While continuous blood sugar monitoring may be the future, at the present the gold standard for doctors is to maintain the serum HbA1c level below 6.5%. This test gives a three-month assessment of blood sugar levels. Below 6.5% the risks of diabetic complications can be classified as low. For levels of 6.5 to 8.5%, the risk is moderate, and above 8.5% the risk becomes high.

Dental risks important for doctors and people living with diabetes

Various indices of periodontal health have been described. The measure of choice is the World Health Organisation's Community Index of Periodontal Treatment Needs (CPITN) recorded using a specially designed colour-coded pocket measuring probe[25]. In the UK this is called a Basic Periodontal Examination (BPE).

This gives six numbers, one in each of three sections comprising molars and premolars on each side and incisors and canines as the central number. This applies to both the maxilla and the mandible making six scores in all. Each section is called a sextant. The maximum score from each sextant is recorded.

The scores of 0 to 1 indicate low risk, 2 to 3 moderate risk and 4 or 4* high risk.

0 **No periodontal problems.**

1 **Bleeding on probing (a sign of gingivitis and poor plaque control).**

2 **Calculus (indicating the need for scaling and root planning by a dentist or hygienist).**

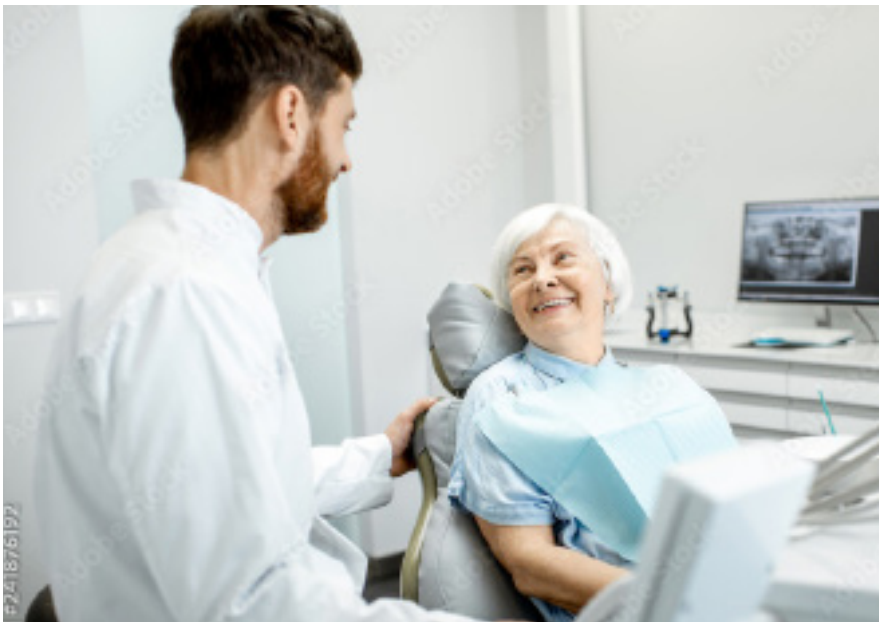
3 **Pockets of 3.5mm to 5.5mm (that is early periodontal breakdown).**

4 **Pockets of 5.5mm to 8.5mm (that is moderately severe periodontal breakdown).**

4* **Pockets greater than 8.5mm (that is a severe periodontal breakdown with an increased risk that teeth will require extraction).**

From these scores the maximum score from one sextant is used.

Using these scores will provide an easily understood method of defining the relative risks into low, moderate or high categories for doctors, dentists and their patients providing that the results are shared and each party knows about them. Two consecutive scores should be recorded to establish trends in disease control.



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> **"For those who do have dental care, NICE has advised that it is important that they attend review appointments at the time intervals recommended by their dentist as determined by their own disease levels."**

Case report

Mrs D aged 76 years has been living with type 1 for over 25 years. Her HbA1c score was 8.6% putting her into the high-risk group.

She was advised that her dental health was satisfactory despite periodontal abscesses and tooth loss. Her BPE score has been 4* also putting her into the high-risk group.

Neither her doctor nor her dentist knew about the other's results and what effect each disease was having on the other, given the two-way relationship between them, because they had not been trained to understand or share them.

Dentists have been taught to ask their patients if they are living with diabetes and to record the name of their GP. The reverse is usually not the case. However, following the recent NICE advice, doctors and their teams will need to do so in future. This should lead to a multidisciplinary approach to care in the longer term.

A simple dental questionnaire has been developed for doctors to investigate the dental status of patients living with diabetes. This could be expanded for audit purposes to correlate the relative risks for both PD and GM but can only apply to those patients receiving dental care. For those patients who do not receive dental care, doctors should consider a suitable referral. To date, such referrals from doctors to dentists have been uncommon. Covid-19 has had a serious impact and is continuing to have an effect on the dental capacity that has been reduced and exacerbated as about 2,000 dentists are reported to have discontinued their NHS contract.

Doctors should, in the first instance, only identify patients living with diabetes who have not had dental care in the highest HbA1c risk category. They can refer to local dental practices or as a last resort to their local hospital's dental department.

This approach should satisfy in part the recent calls that have been made for better cooperation between doctors and dentists in the care of living with diabetes and the sharing of results[26,27].

Daily effective plaque control is most important.

Fortunately, PD is both a treatable and preventable disease the most important component of which is daily efficient and effective control of plaque by patients.

Electric toothbrushes are more likely to remove plaque than hand brushing. Dental floss has been shown to be less effective in controlling plaque than had previously been thought. Where there has been gingival recession the optimum method is the use of interspace brushes making sure that the correct diameter brush is used for each space.

There is no correlation between the handle colours and sizes for different brush manufacturers[28].

Where calculus has developed then professional ultrasonic scaling to remove these deposits and biofilm from the roots is necessary. Loose teeth may require extraction.

Plaque control also removes the bacteria associated with tooth decay or caries. People living with diabetes may have a raised level of sugar in their saliva. If the salivary flow and its buffering capacity are reduced because of a dry mouth the risk increases. It also increases when fruit juices are swallowed because these bacteria break down sugar to form acids that begin to decalcify teeth within about a minute and this can last for up to 20 minutes.

For those who do have dental care, NICE has advised that it is important that they attend review appointments at the time intervals recommended by their dentist as determined by their own disease levels[29].

Action plan for healthcare professionals

- Doctors need to recognise that periodontal disease is the sixth complication of DM and has an important influence on glycaemic control. They should ask their patients with diabetes questions about their dental health and dental attendance following the new NICE guidelines[30]. They will have to understand a simple screening measure for periodontal disease such as BPE.
- If their patients do not have dental care[31] and are in the highest risk category with HbA1c levels of 8.5% or over they should be advised that dental care may help them and a referral made for a basic periodontal assessment.
- Dentists will need to be taught about HbA1c levels and how this affects medical risks.
- Doctors and dentists need to work more closely together in diabetes care.
- People living with diabetes should be encouraged to know about their HbA1c and BPE scores and share them with their respective professional advisors as a first stage in developing better interprofessional cooperation.
- Audits of diabetes patients in the high-risk category who have been advised by their doctor to seek dental care, to help identify if the advice has been taken and what effect dental treatment has had on glycaemic control.

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