

Guideline



Oral health

for people with diabetes



unite for diabetes



International Diabetes Federation

The mission of the International Diabetes Federation is to promote diabetes care, prevention and a cure worldwide

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Clinical rationale

Maintenance of proper oral hygiene for good oral health is an accepted part of the normal recommendations for a healthy lifestyle. Poor oral hygiene is associated with gingivitis, which can progress to more severe infection and inflammation leading to periodontitis. Infectious disease is known to be more common in people with diabetes if blood glucose control is poor, and inflammation is known to be associated with a decrease in insulin sensitivity and thus potentially a worsening of blood glucose control.

Both type 1 diabetes and type 2 diabetes carry a high burden of cardiovascular disease (CVD), and indeed it is the principal adverse outcome in type 2 diabetes. This is associated with increased levels of inflammatory markers which may or may not contribute to CVD, but are believed to do so in some other conditions such as rheumatoid arthritis, in which treatment of the inflammation appears to reduce the risk of CVD.

These observations raise the question of interactions between diabetes and the inflammatory process in periodontitis; recently a number of national and international consensus statements have appeared on the issue. The International Diabetes Federation (IDF) and World Dental Federation (FDI) therefore came together under the lead of the IDF Task Force on Clinical Guidelines to address whether the evidence base in this area allowed formal recommendations on oral health and diabetes care to be made. The focus has been placed here on activity within diabetes care.

Two clinical questions were addressed:

1. What level of surveillance for periodontal disease should be recommended for people with known diabetes?
2. Is active management of periodontitis particularly recommended for people with diabetes?

Guideline process

The challenge of the relentless rise in numbers of people living with diabetes worldwide is felt notably by those professionals concerned with their medical care, but increasingly also by those providing dental care. This calls for better communication between the two groups. Following a preliminary agreement reached at the FDI headquarters in Geneva, a meeting in Dubai in 2007 brought together diabetes and dental health professionals representing IDF and FDI; the IDF website hosts a statement drawn up at this meeting¹. In 2008 a meeting was convened at the Dasman Center for Research and Treatment of Diabetes in Kuwait to see whether there was sufficient evidence to justify a guideline on oral health for people with diabetes, bearing in mind that the topic was not addressed in the 2005 Global Guideline for Type 2 Diabetes². The participants ('Guideline Group') were drawn from the diabetes and oral health

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communities and included the past and present Chairs of the IDF Task Force on Clinical Guidelines. The process followed IDF's own recommendations on development of evidence-based guidelines³.

Formal presentations covered some of the issues in developing evidence-based guidelines for a global audience and some of the evidence currently available on the interrelationship between diabetes and oral health, particularly periodontal disease. Any guideline addressed to the diabetes community would have to introduce some of the oral health detail, so simple explanations were provided by experts in dental healthcare. Nevertheless the guideline was envisaged as being for use by diabetes healthcare professionals. The primary question addressed was whether, in an already crowded diabetes care agenda, oral health problems merited attention.

The meeting did not formally address the complex topic of screening for diabetes within the context of dental care, or the management of diabetes during extended dental procedures. There are currently no generally agreed methods within the diabetes community for opportunistic detection of undiagnosed diabetes, which anyway will vary considerably by region according to the resource base and underlying prevalence of diabetes. Management of diabetes during interventional procedures depends on current glucose-lowering treatment and on the severity of the procedure. General guidelines already exist for in-patients², but management of diabetes dur-

ing investigations or procedures is usually regarded as a separate issue.

The Guideline Group included a professional with specific expertise in literature review and evidence collection, as well as dental expertise. Prior to the meeting the literature linking periodontitis and diabetes was searched for relevant clinical trials. Because of the paucity of direct evidence in the area, reviews and guidelines (systematic and otherwise) were also sought, and from these some English-language references were extracted. This evidence was made available to the Group and discussed at the meeting. Subsequently a medical writer engaged by IDF and with guidelines experience prepared a draft document, which was circulated to the Group and revised in the light of their comments. The revised draft was then sent out by IDF and FDI for wider consultation. Comments received were reviewed by the two Chairmen in conjunction with the writer and the IDF project manager, and changes were made where appropriate. A final draft was circulated to the Group for their approval.

This initiative was fully supported by the Kuwait Foundation for the Advancement of Science (KFAS), with no support from industry. No input from any commercial organization was allowed into the development of this guideline prior to the consultation stage when comments were invited from any interested party.

Evidence review

Periodontal diseases: pathology and symptoms

The dental professionals saw periodontal diseases as the main oral health problem in people with diabetes. While many people probably visit a dentist when they are in pain (and perhaps expect a drill to be used to remove decayed material from a tooth), they are less likely to be aware of changes occurring in the tissues which surround and support the teeth, known collectively as the 'periodontium'. Those able to access preventive care will have their periodontal health assessed and maintained by their dentist.

Gingivitis is a reversible inflammation of the gum (gingiva), which may or may not lead on to the more serious periodontitis affecting the connective tissue and bone supporting the tooth. Dental plaque, which builds up on the tooth surfaces, is a sticky 'biofilm' containing colonies of bacteria. Most of the 600 species of bacteria which may be found in the mouth are likely to be harmless, but some are known to be involved in oral disease. Oral hygiene (self-care), which includes brushing with or without toothpaste and flossing and/or mouth-rinses, aims to remove plaque. Dentists use a plaque index to assess oral hygiene.

Current understanding is that periodontal diseases mainly begin with an inflammatory response to Gram-positive bacteria, manifested as gingivitis (red and swollen gums). In susceptible individuals the effects spread into the periodontium, down into a pocket between the gum and the tooth, where there is a change to Gram-negative bacteria,

and more inflammatory response leading to breakdown of the connective tissue and bone. Unchecked, there will be further changes in microflora, with further inflammation and further destruction. Although this process is localized, it has systemic inflammatory effects detectable through increased serum levels of inflammatory markers such as C-reactive protein (CRP) and interleukin-6 (IL-6). Treatment using antibiotics may have a short-term clinical effect.

Studies of periodontal diseases include measures of gingivitis (gingival index 0-3, where 2 or 3 indicates bleeding) and of periodontitis (assessed by a manual periodontal probe). 'Probing pocket depth' is the distance between the gingival margin and the base of a pocket. 'Attachment loss' is the distance between the cemento-enamel junction of the tooth and the base of a pocket. Bone loss (assessed by radiography), tooth loss, and both severity (at any one site) and extent (number of teeth involved) may be included in the final measure of periodontitis. In the literature the terms slight (or mild), moderate, and severe (or advanced) are variously used to describe this. Increased probing depth, indicative of periodontal damage, may be seen in adolescents and even in children.

Once the periodontium is affected, it is necessary to disrupt the biofilm mechanically (debridement, referred to as scaling), and allow healing (adjunctive antibiotic therapy may sometimes be used). This is not something that can be achieved by self-care, although ongoing self-care is needed after professional treatment.

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In research studies, local effects can be assessed by measuring inflammatory mediators in samples of gingival crevicular fluid. Powerful new techniques are beginning to be applied to the genomics and metagenomics of gut micro-organisms, and possible links with obesity, inflammation, and glucose and lipid metabolism are of interest to investigators of oral disease and of diabetes. Members of the Group drew attention to the importance of considering potential differences between type 1 diabetes and type 2 diabetes when dealing with such issues as inflammation and bone resorption.

The evidence that was considered drew heavily on two recent reviews^{4,5} and two meta-analyses^{6,7}. Some individual studies were also considered.

Prevalence of periodontal diseases

For the general population, prevalence of advanced periodontitis in Western populations seems to have decreased in the second part of the 20th century, but it is not clear how much of this is due to better oral hygiene, less smoking (which is an independent risk factor for periodontitis), better diagnosis and management, or changing thresholds for definition⁸. One recent review suggests that 50% of all age groups in the US population have reversible gingival inflammation, with moderate to severe periodontitis affecting 5% to 15% of any population⁴. Indicators for periodontal disease severity which can be used to assess national and local levels have now been defined and published for Europe⁹ and for Africa¹⁰. In populations where smoking is increasing, an increase in periodontal disease is to be anticipated.

Periodontal diseases in diabetes

Given the uncertainties indicated above, we should not expect clear-cut figures for prevalence of periodontal disease in people with diabetes. In their 2008 review, Taylor and Borgnakke examined 17 cross-sectional studies reported since 2000, and considered that these reinforced the impression gained from a previous analysis of 48 observational studies reported between 1960 and 2000 that diabetes adversely affects periodontal health⁴. However, they made no formal assessment of the quality of the reports. A meta-analysis of 23 cross-sectional or cohort studies reported between 1970 and 2003 found greater severity but the same extent of periodontal disease in people with diabetes compared with those without diabetes⁶.

Several of these studies failed to distinguish between type 1 diabetes and type 2 diabetes, and other sources of heterogeneity included age, and duration of diabetes. Periodontal destruction can start very early in life, as demonstrated in a recent case-control study of children and adolescents (age 6-18 years)¹¹. When compared with a non-diabetic control group of 160 with comparable caries experience, the case group of 182 children with type 1 diabetes had significantly higher plaque and gingival inflammation levels and significantly more teeth with evidence of attachment loss. A study in which 18 individuals (age 15-36 years) refrained from oral hygiene measures for 21 days allowing 'experimental gingivitis' to develop in response to accumulation of plaque, found that the group with type 1 diabetes (with good to moderate metabolic control)

developed an earlier and significantly higher inflammatory response to a comparable bacterial challenge than did the age- and gender-matched control group without diabetes¹². Resumption of oral hygiene measures restored gingival health in both groups.

Periodontal diseases and glycaemic control

Is there an association between periodontal disease and poorer glycaemic control in people with diabetes? The review by Taylor and Borgnakke considered 12 studies reported since 2000, of which eight found periodontal disease to be more prevalent or more severe in those with poorer glycaemic control, whereas the other four found no difference⁴. It was pointed out that these were cross-sectional studies using convenience samples from hospital out-patients and clinics. The meta-analysis by Khader et al. found no statistically significant difference in the percentage of sites with bleeding on probing, surfaces with plaque deposits, or sites with pockets among people with diabetes when they were categorized as having poorly, moderately or well controlled diabetes⁶.

Periodontal treatment and glycaemic control

Does treatment of periodontitis affect glycaemic control in people with diabetes? Periodontal treatment usually consists of the disruption of dental biofilms and the removal of any deposit. A meta-analysis of 10 intervention studies, involving 456 people with diabetes, assessing periodontal treatment as predictor of HbA_{1c}, found weighted average reductions of 0.38% in all studies, 0.66% in studies which

included only people with type 2 diabetes, and 0.71% where antibiotics were given (in addition to debridement), but none was statistically significant⁷. A recent study (responding to the call for further studies in better defined groups) found no effect of periodontal treatment on glycaemic control in people with type 1 diabetes¹³.

Very recently, a meta-analysis of nine intervention studies of 485 people with diabetes concluded that periodontal treatment could lead to a significant 0.79% (95% CI 0.19, 1.40) reduction in HbA_{1c} level, but the authors urged caution in interpreting this result¹⁴. Regardless of the possible effects on diabetes control, periodontal treatment may be expected to prevent loss of teeth, and to improve appearance and function.

Periodontal diseases and complications of diabetes

It has been remarked that the periodontium is a richly vascularized end organ, similar in many respects to the retina and the glomerulus, and indeed there is considerable research interest in whether the changes underlying the vascular complications of diabetes may also be occurring in the periodontium⁵.

Evidence on periodontal disease and complications of diabetes comes very largely from the longitudinal study initiated in 1965 of diabetes and its complications in the Gila River Indian Community of Arizona, USA, specifically from those whose heritage was at least half Pima

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or the closely related Tohono O'odham Indian. In a global context this must be considered an unusual population, as it has an extremely high prevalence of type 2 diabetes (and of kidney disease), but biennial research visits (which included a dental examination in the years between 1983 and 1990) have provided a wealth of information. An early analysis found that nearly all Pima Indians aged ≥ 55 years had periodontal disease, regardless of diabetes¹⁵.

More recently Saremi et al. looked at deaths that had occurred in the interval between the initial examination (from 1983) and 1998 in 628 people with type 2 diabetes aged ≥ 35 years¹⁶. The median follow-up period was 11 years, and death rates were age- and sex-adjusted to the 1985 Pima population. They found that those who had severe periodontal disease at baseline had 3.2 (95% CI 1.1-9.3) times the risk of cardiorenal mortality compared with the reference group (no or mild periodontal disease and moderate periodontal disease combined). Cardiorenal mortality included ischaemic heart disease (IHD) and diabetic nephropathy combined, and it was pointed out that the introduction of renal replacement therapy had meant that more of this population were now dying of IHD where they might previously have died of nephropathy. Most of the individuals with severe periodontal disease were edentulous (72% of extractions being due to periodontal disease).

Shultis et al. looked at the development of macroalbuminuria and end-stage renal disease (ESRD) in this same

population¹⁷. They analysed data from 529 individuals with type 2 diabetes aged ≥ 25 years, and separated out the edentulous 20% from the other severe periodontitis group (22%). They found that age- and sex-adjusted incidence of macroalbuminuria and ESRD increased with severity of periodontitis, with highest rates in the edentulous group. Hazard rate ratios compared with no/mild periodontitis were attenuated after adjustment for glycaemic control.

The only other study mentioned in the recent review by Taylor and Borgnakke⁴ is from Sweden, involving 39 case-control pairs of people with long-duration diabetes who had either severe (case group) or minor (control group) periodontal disease. At follow-up (after median six years) significantly higher prevalences of proteinuria and cardiovascular complications were found in the case group¹⁸.

Other oral diseases in diabetes

There is some evidence for increased prevalence of dry mouth (xerostomia) in diabetes, but much of this is likely to relate to very poor blood glucose control or use of specific medications (such as tricyclics for neuropathic pain). Group opinion was that this was an exacerbating factor for the development or progression of periodontal disease. The evidence on caries is confused, and was not considered further during the meeting. The question was raised as to nutritional recommendations for the prevention of periodontal disease, but the evidence here is apparently only for caries.

Consideration

The Guideline Group recognized that the evidence on diabetes and periodontal diseases was of variable quality, and that more research was clearly required. At present the level of evidence does not allow a conclusion either that specific surveillance programmes for periodontal disease should be instituted in people with diabetes, or that periodontal diseases should be managed any more actively in people with diabetes for specific immediate or long-term gain. Nevertheless it was noted that warning symptoms of periodontal diseases were easily ascertained by non-dental professionals, that people with diabetes already had annual review of health and complications, and that guidelines for the general population already covered daily oral hygiene and regular professional dental checks.

The association of diabetes with a condition which would have adverse effects on quality of life meant that efforts to prevent its developing in the first place should be encouraged, and would be likely to be cost-effective if delivered within the envelope (same staff and clinical visits) of current diabetes care. Few studies exist of the financial impact of an interaction between periodontitis and diabetes. Albert and colleagues did find increased costs for people with diabetes but acknowledged that their study had significant limitations¹⁹.

The Group discussion addressed the issue of levels of care, as used in the Global Guideline for Type 2 Diabetes, to address the geographical variation in resources avail-

able for diabetes care. However, in the nature of the recommendations drawn up, it was not found necessary to adopt this structure. It was pointed out that the consequences of tooth loss were likely to be more serious in less well-resourced populations (where dentures might not be available) and that this would present problems for nutrition, especially among the elderly.

Recommendations on clinical care for people with diabetes

1. Enquire annually as to whether each person with diabetes follows local recommendations for day-to-day dental care for the general population, and (where access permits) attends a dental professional regularly for oral health check-ups.
2. Enquire at least annually for symptoms of gum disease (including bleeding when brushing teeth, and gums which are swollen or red).
3. In those people not performing adequate day-to-day dental care, remind them that this is a normal part of diabetes self-management, and provide general advice as needed. Advise those not attending for regular dental check-ups on the importance of doing so (where access permits).
4. In those people with possible symptoms of gum disease, advise them to seek early attention from a dental health professional.
5. Education of people with diabetes should include explanation of the implications of diabetes, particularly poorly controlled diabetes, for oral health, especially gum disease.

Implementation

Professional education and awareness within the diabetes community will need to be enhanced before these recommendations are likely to be widely adopted. Healthcare professionals should be empowered to explain the need for oral hygiene and the background to their enquiries about gum disease. They should be aware that certain medications (notably calcium channel blockers, tricyclics) may result in dry mouth (xerostomia), which is likely to increase the accumulation of plaque and the risk of oral diseases. Communication between diabetes and oral healthcare professionals could facilitate this empowerment.

Oral health education for people with diabetes may be provided by any suitably trained healthcare professional. In situations where possible symptoms of gum disease require attention but no dental practitioner is available (limited resources, remote locations), an oral healthcare professional with specific training and expertise may be involved.

Liaison may be appropriate with those who are developing community preventive measures and oral health promotion.

Those involved in diabetes care should cooperate in the detection and management of diabetes within the oral health environment. Precise relationships will have to depend on local healthcare structures.

Questionnaires being developed to assist in the assessment of periodontal disease status include an eight-question version which is undergoing validation in a population with diabetes in the USA²⁰. If this is to be used elsewhere, it will need validation in populations with diabetes in other parts of the world.

It is to be hoped that the deficiencies in our understanding of the interrelationship between diabetes and oral health will be addressed by collaborative research, both basic and clinical. This should allow future versions of this guideline to be developed on a firmer evidence base.

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