Diabetes Mellitus: Update and Relevance for Dentistry

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LEARNING OBJECTIVES

After reading this article, the individual will learn:

- The role of general dental practitioners in identifying, monitoring, and actively managing patients with diabetes mellitus (DM).
- The need for collaboration between dental and the medical practitioners for patients with DM.

ABOUT THE AUTHOR

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*Disclosure:* Dr. Ali reports no disclosures.

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*Disclosure:* Dr. Kunzel reports no disclosures.

INTRODUCTION

Diabetes mellitus (DM) is a growing public health problem worldwide. Although there are advanced diagnostic tools for DM, the etiology of DM is not fully understood. DM is a metabolic disorder characterized by chronic hyperglycemia resulting from defects in beta cells in the pancreas (insulin producing cells), insulin action, or both. The American Diabetes Association (ADA) classifies DM based on disease etiology into type 1 DM and type 2 DM. There are also other relatively less common types of diabetes such as gestational DM and drug/infection induced DM.

This article reviews the most current information on DM and discusses the relevance of this disease to the practice of dentistry.

**TYPE 1 DIABETES MELLITUS**

This class of DM results from autoimmune destruction of the insulin-producing beta cells of the pancreas. It commonly occurs in childhood and adolescence and it affects 5% to 10% of the diabetic population worldwide. In type 1 DM, the destruction of beta cells causes an insulin deficiency, which in turn results in hyperglycemia. Patients with type 1 diabetes are also more prone to other autoimmune disorders such as Graves’ disease, Hashimoto’s thyroiditis, and Addison’s disease.

**TYPE 2 DIABETES MELLITUS**

This class of diabetes constitutes 90% to 95% of total diabetic cases. This type of diabetes results from impaired insulin function or insulin resistance. These patients have relative, rather than absolute, insulin deficiency. The specific cause of this type of diabetes is unknown. Type 2 diabetes is more prevalent in the aged population and people with hypertension, dyslipidemia, obesity, and a lifestyle lacking of physical activity.

**GESTATIONAL DIABETES MELLITUS**

This type of diabetes is defined as a degree of glucose intolerance during pregnancy. In the United States, gestational DM affects 4% of all pregnancies. In most cases, glucose levels will return to normal after delivery.
However, women who have had gestational DM have higher chances of developing type 2 DM later in life.

**OTHER SPECIFIC TYPES OF DIABETES MELLITUS**

These are relatively rare and associated with genetic defects of beta cell function or insulin action, diseases of the endocrine system or rare complications of certain medications. There are other conditions, including excess amounts of epinephrine, glucagon, and growth hormone, that may also cause an insulin secretion defect. Certain drugs such as glucocorticoids, thiazides, dilantin, and interferon-alpha can interfere with insulin secretion. In addition to an autoimmune reaction, viruses such as cytomegalovirus, mumps, and coxsackie virus have been shown to be associated with beta cell destruction.\(^6\)

**UNDIAGNOSED DIABETES**

According to data provided by the US Centers for Disease Control and Prevention (CDC) National Diabetes Fact Sheet 2011, the number of undiagnosed diabetic patients is not known.\(^7\) Studies have shown that screening for type 2 diabetes will identify a large number of patients with the “borderline” condition of impaired fasting glycemia and impaired glucose tolerance collectively known as prediabetes. Prediabetic individuals are at high risk of progression to type 2 DM. Prediabetic individuals typically go undiagnosed for a long period of time and are unaware of their condition for an average of 7 years before their first diagnostic test. In severe cases, prediabetic individuals have cardiovascular conditions and poor mortality outcomes.\(^8\)

**MEDICAL COMPLICATIONS OF DIABETES MELLITUS**

It has long been known that DM can cause many serious medical complications such as cardiopathy, nephropathy, neuropathy, retinopathy, atherosclerosis, and strokes.\(^9\) As a result of research conducted during the past 50 years exploring the relationship between DM and periodontitis, it is now recognized that periodontitis may also be a major complication of DM.\(^10\) At the molecular level, it is the increased level of glucose in the blood, resulting in an accumulation of products from the nonmetabolic reaction of glucose with proteins, that is thought to contribute to these complications.\(^11\)

In 2007, the CDC provided remarkable statistics indicating that DM had been the seventh leading cause of death in the United States in 2006.\(^12\) In June 2008 at its 68th Scientific Session, the ADA linked periodontal disease with DM, and listed referrals for comprehensive dental evaluations and treatment of oral diseases as a component of the comprehensive DM evaluation.\(^10\)

Medical complications that are commonly associated with DM include renal disease (diabetic nephropathy), retinopathy (visual impairment, blindness), peripheral vascular disease, and coronary heart disease (CHD) including accelerated atherosclerosis and stroke.\(^13\)

Diabetic kidney disease, or nephropathy, is the most common cause of kidney failure in the United States. One third of patients with type 1 diabetes develop kidney disease. Diabetes damages the small blood vessels in the kidneys, impairing their ability to regulate body fluids and filter blood to remove impurities by excretion in the urine. People with kidney failure must have a kidney transplant or rely on dialysis as a substitute for failed kidneys.\(^3\)

According to the National Eye Institute, a branch of the NIH, approximately 24,000 people with diabetes lose their sight every year. In the United States, diabetic retinopathy is the leading cause of blindness in adults younger than age 65 years.\(^14\)

Peripheral vascular disease, also called peripheral arterial disease or (PAD), and CHD are very common in diabetic patients. In this condition, the blood vessels in the distal extremities are narrowed or blocked by fatty deposits, decreasing blood flow to the lower extremities. Poor circulation in the legs and feet raises the risk of amputation. PAD is a sign of widespread atherosclerosis, which increases the risk of heart attacks and strokes.\(^15\)

**DENTAL COMPLICATIONS ASSOCIATED WITH DIABETES MELLITUS**

Dental complications associated with diabetes include early tooth loss, gingivitis, periodontitis, dental caries, xerostomia, oral burning sensation, taste disturbances, fungal infection, and lichen planus and lichenoid reactions.\(^16,17\) DM is considered one of the major risk factors for periodontal diseases.\(^18,19\) Löe,\(^20\) who conducted several epidemiological studies on type 1 and type 2 DM,
labeled periodontitis as the sixth complication of DM. Due to heredity patterns as well as alteration of their host response and changes in subgingival microflora, vascularity, collagen metabolism and gingival crevicular fluid, diabetic patients, especially uncontrolled patients, have a significantly higher prevalence of severe periodontitis. In addition, it has been repeatedly observed that the tendencies for bone loss and attachment loss, deep pocket depth, tooth mobility, and subsequently early tooth loss are 3 times higher in diabetic patients than healthy individuals.

**DIAGNOSING AND MONITORING DIABETES**

In February 2010, the ADA officially recommended use of the glycosylated hemoglobin (HbA1c) test for the diagnosis and monitoring of DM. The ADA annual report proposes that a finding of HbA1c levels ≥ 6.5% result in the diagnosis of diabetes. The new standards are based on the most recent scientific evidence by the National Glycohemoglobin Standardization Program and the Diabetes Control and Complications Trial (DCCT) assay. In addition to the HbA1c test, other diagnostic tests include a fasting plasma glucose level of ≥ 126 mg/dL, a 2-hour plasma glucose level ≥ 200 mg/dL during an oral glucose tolerance test (OGTT), and a random plasma glucose level of ≥ 200 mg/dL in patients symptomatic for hyperglycemia or hyperglycemic crisis (Table 1).

The HbA1c test has been traditionally used for “long-term” assessment, providing a measure for the average glucose regulation during the prior 6 to 12 weeks. The goal for diabetic patients is to maintain an HbA1c level of less than 7%, which is considered well controlled. As shown in Table 2, several tests are available to help people with diabetes monitor their blood glucose level. Other tests, such as the glucose tolerance test, are used to identify patients with gestational diabetes and impaired glucose absorption.

Diabetes patients must undergo regular monitoring by testing their fasting glucose level and their HbA1c level. Table 3 provides the correlation between HbA1c levels and average plasma glucose levels. The serum fructosamine test is used to measure the diabetic patient’s glycemic control during the 2 to 3 weeks prior to the test. A positive correlation between the degree of gingival bleeding and high fructosamine levels has been reported. The serum fructosamine test is often prescribed for pregnant women, and particularly pregnant women whose glucose and insulin requirements may be affected for a period of time by an acute or systemic illness.

A fasting plasma glucose (FPG) test result ≥ 126 mg/dL is diagnostic for diabetes. If the FPG measure is 110 to 126 mg/dL, then an OGTT should be performed to determine the degree of glucose intolerance. A FPG ≥ 126 mg/dL, a random plasma glucose level of ≥ 200 mg/dL, in addition to the classic symptoms of DM (polydipsia, polyuria, polyphagia, weight loss, and loss of strength), is a clear indicator for DM diagnosis. A positive FPG finding must be confirmed by repeating the test on a subsequent day.

**STUDIES ON TREATING DIABETES MELLITUS AND PREVENTING OR DELAYING TYPE 2 DIABETES**

Several large, controlled clinical trials have established “standard” approaches for treating type 1 and type 2 diabetes, and for preventing/delaying type 2 diabetes. The
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DCCT study for type 1 diabetes, the Epidemiology of Diabetes Interventions and Complications Study, and the United Kingdom Prospective Diabetes Study (UKPDS), for type 2 diabetes, focused attention on the significance of intensive glycemic control in reducing the devastating complications of DM.31

DCCT was a major clinical study conducted from 1983 to 1993 and funded by the National Institute of Diabetes and Digestive and Kidney Diseases. The study showed that keeping blood glucose levels as close to normal as possible slows the onset and progression of the eye, kidney, and nerve damage caused by diabetes. In fact, it demonstrated that any sustained lowering of blood glucose helps in preventing diabetic complications even if the patient has had a history of poor control. The DCCT involved 1,441 volunteers, ages 13 to 39 years, with type 1 diabetes and 29 medical centers in the United States and Canada. The study compared the effects of standard control of blood glucose versus intensive control of the complications of diabetes. Intensive control was defined as maintaining HbA1c levels as close as possible to the normal value of 6% or less.

Epidemiology of Diabetes Interventions and Complications (EDIC) is an ongoing observational study that began in April 1994 and is expected to end in February 2016. The EDIC study follows participants previously enrolled in the DCCT and determines whether the use of intensive therapy as compared to conventional therapy during the time period people were enrolled in the DCCT affected the long-term incidence of cardiovascular disease (CVD). The EDIC study found that the benefits of tight glucose control on eye, kidney, and nerve problems persisted long after the DCCT ended. Researchers call the long-lasting benefit of tight control “metabolic memory.” The long-lasting benefit of tight control persisted following participation in the DCCT, even though the blood glucose levels in the intensive treatment group rose and those of the conventional treatment group declined so that blood glucose levels were nearly the same between treatment groups.32

Table 2. Glycemic Recommendations for Adults With Diabetes Mellitus

<table>
<thead>
<tr>
<th>LABORATORY/GLUCOMETER PARAMETER</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycosylated hemoglobin</td>
<td>&lt; 7.0%&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Preprandial capillary glucose</td>
<td>70 to 130 mg/dL</td>
</tr>
<tr>
<td>Peak postprandial capillary glucose one to 2 hours after beginning of a meal</td>
<td>&lt; 180 mg/dL</td>
</tr>
</tbody>
</table>


<sup>a</sup>The reference range from normal glycosylated hemoglobin is 4.0% to 6.0%.

In the DCCT, the most significant side effect of intensive treatment was the increased risk of severe episodes of hypoglycemia. DCCT researchers estimated that intensive management doubles the cost of managing diabetes because of increased visits to a healthcare professional and the need for more frequent blood testing at home. However, this cost is offset by the reduction in medical expenses related to long-term complications and by the improved quality of life of diabetic patients. Intensive treatment has not been widely recommended for all patients.33

In 1999, the UKPDS reported results similar to those found in the DCCT research. The UKPDS was designed to determine whether a reduction in long-term diabetes complications would be experienced by type 2 diabetes patients given intensive management to control blood glucose levels compared with patients given standard care. The UKPDS was a 20-year clinical trial co-coordinated by the Diabetes Research Laboratories at Oxford.31 UKPDS mirrored the findings of the DCCT in people with type 2 diabetes, showing that tighter blood glucose control reduced the development of diabetes complications.34 As a result, the goal for the treatment of diabetics was significantly changed at that time.

Results of the DCCT and EDIC studies have important implications for preventing complications, especially those involving the microvascular disease development process, in type 2 diabetes patients.32,34
Other studies of the role of blood glucose control in type 2 diabetes patients are still underway. For example, the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial, a multicenter randomized trial, is studying approaches to preventing major cardiovascular events in individuals with type 2 diabetes. ACCORD is designed to compare current practice guidelines with more intensive glycemic control in 10,000 individuals with type 2 diabetes, including those at especially high risk for CVD. The study will also investigate the impact of the treatment strategies on other cardiovascular outcomes; total mortality; limb amputation; eye, kidney, or nerve disease; and health-related quality of life, as well as cost-effectiveness. However, it was observed that the intensive treatment resulted in a large increase in hypoglycemia complications that may outweigh the benefits of the reduction in eye, kidney, and nerve damage. The participants in the intensive treatment group of the ACCORD are being switched to the standard treatment program because of an increased death rate in the intensive treatment program (14 deaths per 1,000 patients per year versus 11 per 1,000 patients per year in the standard treatment program).

At this time, the ADA advises patients with diabetes who have existing CVD, or multiple CVD risk factors, to consult with their healthcare team about their treatment goals and to ensure that their blood pressure and cholesterol are appropriately managed. The treatment guidelines also state that treatment should be tailored on an individual basis.

**IMPLICATIONS OF DIAGNOSIS, ACCOMPANIED BY GLYCEMIC CONTROL, FOR EXPECTED RESPONSE TO DENTAL TREATMENT**

Many studies have been conducted to investigate the relation between glycemic control and periodontal disease in diabetic patients. Studies have concluded that uncontrolled diabetic patients are more likely to develop severe periodontitis. The ADA formally acknowledged the relationship between periodontal disease and DM in the 68th Scientific Session in June 2008, and recommended that the following be included as part of the comprehensive treatment of diabetic patients: annual dilated eye examination, family planning for women of reproductive age, consultation with a registered dietician for medical nutrition therapy, DM self-management education, dental examination and mental health professional examination as needed. Recognition from the ADA that diabetic patients need comprehensive oral evaluation and treatment by dentists is expected to foster and improve cooperation between dental and medical professionals in the treatment of diabetic patients.

### Table 3. Correlation Between HbA1c\(^a\) Levels and Average Plasma Glucose Levels

<table>
<thead>
<tr>
<th>HbA1c LEVEL (%)</th>
<th>AVERAGE PLASMA GLUCOSE LEVEL (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>97</td>
</tr>
<tr>
<td>5.5</td>
<td>111</td>
</tr>
<tr>
<td>6.0</td>
<td>126</td>
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<td>6.5</td>
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<td>8.5</td>
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<td>9.0</td>
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<td>11</td>
<td>269</td>
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<tr>
<td>11.5</td>
<td>283</td>
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<td>12</td>
<td>298</td>
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\(^a\)The reference range from normal glycated hemoglobin is 4.0% to 6.0%.
POTENTIAL BENEFITS OF EARLY DETECTION AND EFFECTIVE MONITORING

Early identification of the prediabetic patient can be beneficial in delaying the onset and perhaps preventing the occurrence of type 2 diabetes. Similarly, timely and effective management of diabetes can reduce the occurrence of the debilitating complications associated with this disease. Further, early detection and primary prevention of type 2 diabetes has been shown to be cost effective, particularly in high-risk groups. The evidence on screening for type 2 diabetes provides a compelling argument that by early detection of type 2 diabetes, diabetic complications and healthcare costs can be reduced. Therefore, screening guidelines for early detection of diabetes in high-risk groups have been developed for use in individuals with high potential for developing DM. The ADA protocol that was released in February 2010 advises monitoring individuals with prediabetes on an annual basis to prevent progression of the disease. The ADA recommended that HbA1c levels of 5.7% to 6.4% be considered a sign of high risk for diabetes. In addition, the report suggests that HbA1c tests be performed at least twice per year in diabetic patients and quarterly for those who either have poor glycemic control levels or have recently altered therapy.

DIABETES MELLITUS SCREENING RECOMMENDATIONS: SCREENING FOR UNDIAGNOSED DIABETES

A study conducted by the ADA regarding screening undiagnosed diabetic individuals found that one third of the screened individuals were undiagnosed diabetic patients, and complications found at the time of diagnosis indicated that the disease may have been present for several years before diagnosis. Due to the serious complications associated with DM, it was urgent for the ADA to establish a guideline for screening patients at risk. The Expert Committee on the Diagnosis and Classification of DM has established a guideline for screening prediabetic/undiagnosed individuals. The proposed guideline is not recommended for the general adult population; it is recommended for individuals with one or more risk factors, which are listed as criteria for testing asymptomatic, undiagnosed individuals. Testing should be considered for those age 45 years and older and repeated every 3 years if results are normal. In addition, testing should be considered in younger individuals or more frequently for those who:

- Are African, Hispanic, Native American, Asian, or Pacific Islander;
- Are overweight (BMI, Kg/m² ≥ 25);
- Have had gestational diabetes or delivered a baby weighing > 9 pounds;
- Have hypertension (blood pressure ≥ 140/90 mmHg);
- Have low high-density lipoprotein cholesterol ≤ 35 mg/dL and/or high triglyceride level (≥ 250 mg/dL);
- Have had impaired glucose metabolism (110 ≤ FPG < 126 mg/dL or 140 ≤ OGTT < 200 mg/dL).

Prediabetes is a serious condition with a high risk of progression to type 2 diabetes and heart diseases. However, prediabetes can be delayed, or even prevented, by lifestyle changes such as engagement in physical activities and following healthy diet plans.

DENTAL OFFICE SCREENING TOOLS

With the increasing number of diabetic patients, it is likely that the dentist will become involved in treating diabetic patients. As the population of diabetic patients increases, dentists in general should be well aware of signs and symptoms of DM and how to treat and tailor the treatment regimen for those individuals. Altered dental treatment for diabetic patients has been described and outlines provided for treating those patients. Therefore, the importance of measuring the dentists’ willingness and knowledge has been emphasized.

Many patients are unaware that they have DM or are at risk for DM. Routinely, in the dental office, patients will complete the medical history questionnaire and have an oral interview during their initial visit. Although the medical history questionnaire may not reveal anything suspicious, upon being asked about general well-being, a patient may mention the classic signs and symptoms of diabetes (the triad of polyuria, polydipsia, and polyphagia). Patients with findings such as headache, dry mouth, repeated skin infection, blurred vision, paresthesia, progressive periodontal disease, multiple periodontal abscesses, and loss of sensation should be screened for hyperglycemia by the finger-stick test or referred for further investigations.
A study by Borrell et al.\textsuperscript{49} reported that screening procedures in the dental office could provide valuable information to identify undiagnosed diabetics. The study used self-reported data and periodontal clinical parameters routinely assessed in the dental office. Their findings suggested that dentists should be encouraged to participate more in detecting the presence of diabetes in undiagnosed patients.

A simple finger-stick screening test could be performed in the dental office for suspected diabetic patients.\textsuperscript{50} The self-monitoring of blood glucose using finger-stick blood samples and test strips has contributed to diabetes management. In contrast, and despite their widespread use among patients, devices that measure the blood glucose level at the moment of use have a high potential for inaccuracy that limits their applicability as screening tools.\textsuperscript{51}

**DIABETIC MANAGEMENT IN THE DENTAL OFFICE**

Controlled diabetic patients absent medical complications can undergo dental treatment requiring little or no modifications. By contrast, patients with medical complications such as cardiovascular or renal problems will need special consideration.\textsuperscript{6} A typical initial action taken by the dentist is consultation with the patient’s physician. Patients with uncontrolled diabetes, or who have not seen their physician for an extended time, should be referred to their physician for evaluation and to establish their current status.\textsuperscript{52,53} An assessment of the HbA1c for the past few months, and the presence or absence of variations among readings, can provide a dentist with a general idea of how well the patient’s glucose level is controlled. In addition, dentists’ involvement in the detection of any oral signs of infection or any other problems that may affect glycemic control is indicated.\textsuperscript{54,55}

Type 1 DM patients are treated with variable doses of insulin, and may have episodes of hypoglycemia and hyperglycemia, even if they are controlled diabetics. These patients need clearance from their physician before receiving dental treatment.\textsuperscript{56,57} One of the major problems in treating type 1 DM patients is the insulin shock that occurs when patients take large doses of insulin with no or little food intake. The best way to prevent this is to instruct the patients to take their usual insulin dose and to have normal meals before coming to the dental appointment, which is usually best scheduled in the early morning. It is the dentist’s duty to confirm with the patients that they have taken their insulin and have had their breakfast. In addition, patients should be instructed to inform the dentist if they feel any weakness or discomfort during the procedure. Orange juice or other sugary beverage should be available in the dental office for use in insulin shock emergencies.\textsuperscript{57}

Diabetic patients who undergo extensive periodontal surgery or oral surgery should give special attention to their diet after the surgery. Their diet must have sufficient amounts of protein and carbohydrates, as well as fluids to prevent dehydration. The patient’s physician must be consulted in that regard as well. Patients on high doses of insulin and having periodontal or surgical procedures may be placed on antibiotic therapy postoperatively to avoid infection.\textsuperscript{6}

If the patient is required to be under intravenous sedation, which requires the patient to fast for about 8 hours prior to the sedation, the patient is instructed to use only half the usual insulin dose, followed by supplementing with intravenous glucose during the procedure. Management of diabetic patients with acute oral infection, or involved in any dental emergency, can be very challenging and may require hospitalization due to the fact that diabetic patients’ defense systems do not function properly.\textsuperscript{58}

**REVIEW OF CURRENT GUIDELINES TO IMPROVE THE TREATMENT OF DIABETIC PATIENTS**

The ADA and the European Association for the Study of Diabetes as well as the International Diabetes Federation (IDF) issued their recommendations in October 2009 on the management of type 2 diabetes. Despite the differences in the guidelines’ strategies and their applications, all the guidelines focus on periodontal disease management that could help reduce the risk of developing diabetes as well as helping diabetic patients control their blood sugar levels. The guidelines encourage oral healthcare providers to perform an annual examination for symptoms of periodontal disease, to educate patients about the effect of DM on oral health, and to increase awareness of the importance of maintaining optimum oral health. In addition, the IDF guideline emphasizes the importance of opportunities for collaboration between dental and medical professionals.\textsuperscript{37,59,60}
SUMMARY
In light of growing evidence of the association between oral and nonoral diseases, some investigators believe that oral disease is a clinically useful predictor of nonoral conditions in certain individuals. As the dental profession has become more involved in treating medically compromised patients, dentistry has gone from being an “oral health profession” to being part of the general health team. As a result, a partnership between dentists and physicians that involves an expanded notion of oral-medical communication during the course of treating such patients should be embraced in order to better serve these patients.

Michael Glick, senior editor of the Journal of the American Dental Association, believes that oral health providers should take an active role in screening certain groups for common medical conditions, ie, to check the patient’s blood pressure, plasma glucose, and cholesterol for indications of heart disease and DM. Furthermore, dentists can be part of the diabetic patient’s support network by becoming actively involved in monitoring blood glucose levels and blood pressure, as well as reminding patients of the importance of having their regular medical exams. Dentists are not going to diagnose or treat a systemic disease, but early detection will certainly result in better medical and dental outcomes. It is the dentist’s role to be a part of the healthcare team in order to help reduce the incidence and adverse impact of diabetes.
REFERENCES


32. DCCT and EDIC: The Diabetes Control and Complication Trial and Follow-up Study 2008.


35. Questions and Answers: Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial.
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POST EXAMINATION QUESTIONS

1. Which of the following statements is TRUE?
   a. The etiology of diabetes mellitus (DM) is fully understood.
   b. Type 1 DM is the most common type
   c. DM is a metabolic disorder
   d. Type 2 DM is more prevalent in young people.

2. Medical complications of DM include:
   a. Cardiopathy.
   b. Nephropathy.
   c. Atherosclerosis and strokes.
   d. all of the above.

3. Type 1 DM results from:
   a. impaired insulin function
   b. autoimmune destruction of pancreas beta cells
   c. insulin resistance
   d. obesity

4. Gestational DM affects ____ percent of all pregnancies in the U.S.
   a. one
   b. two
   c. three
   d. four

5. According to the American Diabetes Association (ADA), a diagnosis of overt DM is made when the HbA1c level is:
   a. 5.7 percent or higher
   b. 6.0 percent or higher
   c. 6.5 percent or higher
   d. 7.5 percent or higher

6. The following drugs can interfere with insulin secretion:
   a. glucocorticoids
   b. thiazides
   c. dilantin
   d. all of the above

7. Diabetic kidney disease is the third most common cause of kidney failure in the United States. One-third of type 1 diabetes patients develop kidney disease.
   a. The first statement is true, the second is false.
   b. The first statement is false, the second is true.
   c. Both statements are true.
   d. Both statements are false.
8. Which of the following is considered a dental complication associated with DM?
   a. dental caries
   b. aphthous ulcers
   c. herpes simplex
   d. all of the above

9. A fasting plasma glucose (FPG) level of _____ is diagnostic for diabetes:
   a. 120 mg/dL or higher
   b. 126 mg/dL or higher
   c. 130 mg/dL or higher
   d. 135 mg/dL or higher

10. Well-controlled diabetic patients absent of medical complications can undergo dental treatment requiring the following:
    a. special considerations needed
    b. referral to physician for evaluation of current status
    c. assessment of HbA1c for the past few months
    d. little or no modifications

11. In February 2010 the ADA officially recommended the following test for the diagnosis and monitoring of DM:
    a. glycosylated hemoglobin
    b. glucose tolerance test
    c. fasting plasma glucose
    d. random plasma glucose level

12. Approximately ______ people with diabetes lose their sight every year.
    a. 24,000
    b. 35,000
    c. 42,000
    d. 55,000

13. Diabetic patients who undergo extensive periodontal/oral surgery should give special attention to:
    a. a diet with sufficient protein and carbohydrates
    b. prevention of dehydration
    c. patients on high doses of insulin may be placed on antibiotic therapy postoperatively
    d. all of the above

14. One way to help prevent insulin shock incidents with type 1 diabetic patients is:
    a. to instruct patients to take half their usual insulin dose
    b. to have normal meals before coming to the dental appointment
    c. to schedule the patient in the late afternoon
    d. all of the above

15. Which association acknowledged the relationship between periodontal disease and DM and recommended comprehensive dental examination as part of comprehensive treatment of diabetic patients?
    a. American Dental Association
    b. American Heart Association
    c. American Diabetes Association (ADA)
    d. The International Diabetes Federation

16. According to the EDIC study, the long-lasting benefit of tight control of blood glucose levels in study participants is called:
    a. “stability effect”
    b. “cellular stabilization”
    c. “metabolic memory”
    d. “EDIC effect”
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☐ I am using a credit card.

My Credit Card information is provided below.
☐ American Express  ☐ Visa  ☐ MC  ☐ Discover

Please provide the following (please print clearly):

Exact Name on Credit Card

Credit Card #

Expiration Date

Signature

PERSONAL CERTIFICATION INFORMATION:

Last Name (PLEASE PRINT CLEARLY OR TYPE)

First Name

Profession / Credentials  License Number

Street Address

Suite or Apartment Number

City  State  Zip Code

Daytime Telephone Number With Area Code

Fax Number With Area Code

E-mail Address

ANSWER FORM: COURSE #: 144

Please check the correct box for each question below.

1. □ a  □ b  □ c  □ d  9. □ a  □ b  □ c  □ d
2. □ a  □ b  □ c  □ d  10. □ a  □ b  □ c  □ d
3. □ a  □ b  □ c  □ d  11. □ a  □ b  □ c  □ d
4. □ a  □ b  □ c  □ d  12. □ a  □ b  □ c  □ d
5. □ a  □ b  □ c  □ d  13. □ a  □ b  □ c  □ d
6. □ a  □ b  □ c  □ d  14. □ a  □ b  □ c  □ d
7. □ a  □ b  □ c  □ d  15. □ a  □ b  □ c  □ d
8. □ a  □ b  □ c  □ d  16. □ a  □ b  □ c  □ d

PROGRAM EVALUATION FORM

Please complete the following activity evaluation questions.

Rating Scale: Excellent = 5 and Poor = 0

Course objectives were achieved.

Content was useful and benefited your clinical practice.

Review questions were clear and relevant to the editorial.

Illustrations and photographs were clear and relevant.

Written presentation was informative and concise.

How much time did you spend reading the activity and completing the test?