Diabetes mellitus

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Fourth Stage
Oral Surgery

Diabetes mellitus is the third most common cause of death in the United States, and it is increasing significantly. 6% increase in the incidence of diabetes mellitus (DM) in only 1 year.
The major reason is obesity; More than 240 million persons worldwide have diabetes mellitus, and health officials estimate that this figure will double or triple within the next 10 years.

DM is a disease complex with metabolic and vascular components. This chronic disease is characterized by hyperglycemia and complications that include microvascular disease of the kidney and eye and a variety of clinical neuropathies.
It is associated with chronic, premature macrovascular disease and serious microvascular disease.
The metabolic component involves the elevation of blood glucose associated with alterations in lipid protein metabolism, resulting from a relative or absolute lack of insulin.
Maintenance of good glycemic control can prevent or retard the development of microvascular complications of diabetes. Retinopathy and nephropathy are eventual complications, given sufficient duration, in nearly every individual with diabetes. These complications result in serious morbidity and are so characteristic of diabetes that the classification of diabetic type is dependent on their presence.
A crucial aspect of identification of the dental patient with diabetes is the ability of the dentist to recognize the level of severity and of glycemic control, as well as the presence of complications from diabetes, so that he or she can treat the patient appropriately. Essential to this determination is knowledge of the patient's blood glucose level at the time that dental treatment is provided. Although the problem extends across all age groups, the largest group of individuals in this category is 30 to 39 years old. Approximately 1 million new cases of diabetes emerge in the United States each year.
The prevalence of type 2 diabetes is approximately 10 times that of type 1. The vast majority of undiagnosed cases of diabetes are of the type 2 variety.

Mortality and Morbidity: Relative to Glycemic Control
Rates of associated morbidity are extremely high. The risk of acquire end-stage renal disease is 25 times in DM than that of individuals without diabetes. Additionally, 25% of all new cases of end-stage renal disease result from diabetes mellitus.
The risk of amputation of an extremity because of diabetic complications is more than 40 times that of normal persons; more than 20,000 amputations are performed per year on patients with diabetes mellitus,
Retinopathy occurs in all forms of diabetes. As with other complications of diabetes, the development of retinopathy (and blindness) varies with duration and control of the disease. The risk of blindness is 20 times greater in diabetes than that of other individuals.

Susceptibility to myocardial infarction and stroke in patients with diabetes is 2 to 5 times greater than in those without the disease.
The severity of these (and other) complications of diabetes is largely dependent on the degree and level of control of hyperglycemia.
The most significant risk factors for type 2 diabetes are family history and obesity. About 60% to 70% of patients with type 2 diabetes are obese at the time of diagnosis.

The glycosylated hemoglobin value (HbA1c) is the primary target for glycemic control. The goal for patients in general is an HbA1c value of less than 7%, and the goal for each individual patient is as close to normal (less than 6%) as is possible without the occurrence of clinically significant hypoglycemia. Unfortunately, these goals are often unmet.

What is HbA1c?

The term *HbA1c* refers to glycated haemoglobin. It develops when haemoglobin, a protein within red blood cells that carries oxygen throughout your body, joins with glucose in the blood, becoming 'glycated'.

By measuring glycated haemoglobin (HbA1c), clinicians are able to get an overall picture of what our average blood sugar levels have been over a period of weeks/months.

For people with diabetes this is important as the higher the HbA1c, the greater the risk of developing diabetes-related complications.
HbA1c is also referred to as **haemoglobin A1c** *or* simply **A1c**.

Etiology
Diabetes mellitus may be the result of any of the following:

- A genetic disorder
- Primary destruction of islet cells through inflammation, cancer, or surgery
- An endocrine condition such as hyperpituitarism or hyperthyroidism
- An iatrogenic disease that occurs after steroids have been administered.

Studies of identical twins have shown that if one twin develops type 1 diabetes, the other twin has about a 50% chance of getting the disease. Additionally, if one identical twin develops type 2 diabetes, the other has a 100% chance of also developing it.
Obesity plays an important part in the development of type 2 diabetes, but how this occurs is not well understood.

Gestational diabetes mellitus (GDM) occurs as the onset of impaired glucose tolerance (IGT) or clinical diabetes during pregnancy. The condition of patients usually returns to normal after the birth of the child, but they have an increased risk of developing diabetes

within 5 to 10 years. GDM enhances risk for loss of the fetus and is associated with increased size of surviving fetuses.
Patients with clinical signs and symptoms of diabetes mellitus may have type 1, type 2, or another type of diabetes. These individuals exhibit an elevation in fasting blood glucose, abnormal glucose tolerance test results, and microangiopathy.

In type 1 diabetes often is diagnosed in individuals younger than 40 years age; it may, however, occur at any age.
Type 2 diabetes generally occurs after age 40 in obese individuals. The incidence of type 2 diabetes
increases with age, and insulin secretion may be low, normal, or high.

Pathophysiology and Complications

Glucose is the most important stimulus for insulin secretion. Insulin remains in circulation for only several minutes (half-life [t1/2], 4 to 8 minutes); it then interacts with target tissues and binds with cell surface insulin receptors. Secondary intracellular messengers are activated and interact with cellular effector systems, including enzymes and glucose transport proteins. Lack of insulin or insulin action allows glucose to accumulate in the tissue fluids and blood.
The brain and nervous system do not require insulin, so the patient will continue to use carbohydrates at the usual rates. However, other tissues in the body are unable to take glucose into the cells or to use it at a normal rate.
Thus, the rise in blood glucose in diabetic persons results from a combination of underutilization and overproduction, (Increased production of glucose from glycogen, fat, and protein), attained through glycogenolysis and fat metabolism.
Hyperglycemia leads to glucose excretion in the urine, which results in increased urinary volume. The increase in fluid lost through urine may lead to dehydration and loss of electrolytes. With type 2 diabetes, prolonged hyperglycemia can lead to significant losses of fluid in the urine. When this type of severe dehydration occurs, urinary output drops, and a **hyperosmolar non-ketotic coma** may result. This condition is seen most often in elderly patients with type 2 diabetes.
Lack of glucose utilization by many cells of the body leads to cellular starvation. The patient often increases intake of food but in many cases still loses weight. If these events continue to progress, the person with type 1 diabetes develops metabolic acidosis.
For a time, the body may be able to maintain the pH at nearly normal levels; but as the buffer system and respiratory and renal regulators fail to compensate, body fluids become more acidic (i.e., pH falls). Severe acidosis will lead to coma and death if it is not identified and treated.

TABLE 15-3
Prevalence of Complications in Patients With Insulin-Dependent Diabetes Mellitus (IDDM)

Complication	Cumulative Prevalence
Visual impairment	14%
Blindness	16%
Renal failure	22%
Stroke	10%
Amputation	12%
Myocardial infarction	21%
Median years of survival after diagnosis of type 1 diabetes	39
Median age at death, y	49

Hyperglycemia plays a role in the evolution of atherosclerotic plaques. Individuals with uncontrolled diabetes have increased levels of low-density lipoprotein (LDL) cholesterol and reduced levels of high-density lipoprotein (HDL) cholesterol. Attainment of normal glycemia often improves the LDL/HDL ratio.

BOX 15-2

Complications of Diabetes Mellitus

- Ketoacidosis (type 2 diabetes)
- Hyperosmolar nonketotic coma (type 2 diabetes)
- Diabetic retinopathy/blindness
- Cataracts
- Diabetic nephropathy/renal failure
- Accelerated atherosclerosis (coronary heart disease[1])
- Ulceration and gangrene of feet
- Diabetic neuropathy (dysphagia, gastric distention, diarrhea, impotence, muscle weakness/cramps, numbness, tingling, deep burning pain)
- Early death

A major determinant of the morbidity associated with poor glycemic control in diabetes is accelerated atherosclerosis. Atherosclerosis increases the risks of:

- Ulceration
- Gangrene of the feet
- Hypertension
- Renal failure
- Coronary insufficiency
- Myocardial infarction MI
- Stroke

The most common cause of death in patients with type 2 diabetes is myocardial infarction MI.

In the extremities, diabetic neuropathy may lead to muscle weakness, muscle cramps, a deep burning pain, tingling sensations, and numbness. In addition, tendon reflexes, two-point discrimination, and position sense may be lost. Some cases of oral paresthesia and burning tongue are caused by this complication.

Diabetic neuropathy also may involve the autonomic nervous system. Esophageal dysfunction may cause dysphagia, stomach involvement may cause a loss of motility with massive gastric distention, and involvement of the small intestine may result in nocturnal diabetic diarrhea.

Sexual impotence and bladder dysfunction also may occur. Diabetic neuropathy is common with type 1 and type 2 diabetes and may occur in more than 50% of patients. Neuropathy progresses over time in type 2 diabetes, and this increase may be greater in patients with hypoinsulinemia. Other complications include decubitus ulcerations, gangrenous extremities, cataracts, skin rashes, and deposits of fat in the skin (xanthoma diabeticorum).

Eruptive xanthoma

CLINICAL PRESENTATION

Signs and Symptoms

In patients with type 1 diabetes, the onset of symptoms is sudden and more acute. Symptoms include polydipsia (increased thirst), polyuria (frequent, excessive urination), polyphagia (excessive hunger), loss of weight, loss of strength, marked irritability, recurrence of bed wetting, drowsiness, and malaise. Patients with severe ketoacidosis may experience vomiting, abdominal pain, nausea, tachypnea, paralysis, and loss of consciousness. The onset of symptoms in type 2 diabetes usually is insidious, and the cardinal signs (polydipsia, polyuria, polyphagia, weight loss, and loss of strength) are less commonly seen.

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Other signs and symptoms related to the complications of diabetes include skin lesions, cataracts, blindness, hypertension, chest pain, and anemia. The rapid onset of myopia in an adult is highly suggestive of diabetes mellitus.

Laboratory Findings

Two groups of patients should be screened for diabetes mellitus: (1) those individuals with signs and symptoms of diabetes or its complications, and (2) high-risk ethnic groups (i.e., African Americans, Hispanics, Native Americans, Asian Americans, and Pacific Islanders). Persons with HDL cholesterol levels lower than 35 mg/100 mL or triglyceride levels greater than 250 mg/100 mL, those who have relatives with diabetes, persons who are obese or older than 45 years of age, those who have had GDM, and individuals who have delivered large babies (>9 lb) or who have had spontaneous abortions or stillbirths should be screened at periodic intervals.

The diagnosis of diabetes is established by the presence of a symptom complex that consists of the following:

- Cardinal symptoms of polydipsia, polyphagia, polyuria, loss of strength, and unexplained weight loss
- Microangiopathy involving the retina
- Abnormal glucose metabolism seen on clinical laboratory test results that show glucose and acetone in the urine
- Fasting blood glucose (no caloric intake for at least 8 hr) level at or above 126 mg/100 mL
- 2-Hour postprandial (after a 75-g glucose load) blood glucose level at or above 200 mg/100 mL
- Lowered oral glucose tolerance level

The use of laboratory tests for the diagnosis of diabetes mellitus has changed since 1997. Before then, the glucose tolerance test was considered the diagnostic laboratory test. Since then, fasting glucose level has become the standard laboratory test.

Levels of glycohemoglobin (HbA1c), also known as *glycosylated hemoglobin*, in red blood cells are used for the general assessment of the long-term level (and control) of hyperglycemia in diabetic patients.

Fasting venous blood glucose; The 1997 ADA criteria for the diagnosis of diabetes mellitus state that diabetes is present if the fasting blood glucose level is 126 mg/100 mL or greater on two or more occasions.

Two-hour postprandial glucose; For the 2-hour postprandial glucose test, the patient is given a 75- or 100-g glucose load after a night of fasting. Blood glucose levels taken at 2 hours that are 200 mg/100 mL or higher on two or more occasions are diagnostic of diabetes mellitus.

Oral Glucose Tolerance Test; The glucose tolerance test reflects the rate of absorption, uptake by tissues, and excretion in the urine of glucose.
Venous blood samples are drawn from the arm just before and 1, 2, and 3 hours after ingestion of glucose. Urine samples also are collected at each interval.
The most characteristic alterations seen in diabetes are an increased fasting blood glucose **(126 mg/100 mL or higher)**, an increased peak value **(200 mg/100 mL or higher)**.
As was previously mentioned, the glucose tolerance test is no longer the standard for diagnosing diabetes mellitus. This test is used to identify patients with impaired glucose absorption and gestational diabetes.

Glycohemoglobin; The extent of glycosylation of hemoglobin A (a nonenzymatic addition of glucose) that results in formation of HbA1c in red blood cells is used for general assessment of the long-term level (and control) of hyperglycemia in patients with diabetes.
Normally, patients should have 6% to 8% HbA1c. In well-controlled diabetes cases, the level should stay below 7%.
Complications from diabetes are accelerated in individuals with elevated HbA1c.

Urinary Glucose and Acetone; Determination of urinary glucose and acetone is of limited value in detecting overt diabetes.

MEDICAL MANAGEMENT

Diabetes mellitus is not a curable disease. Current evidence supports no precise relationship between hyperglycemia and the vascular complications of diabetes.

Parameter	Normal
Premeal plasma glucose (mg/dL)	<100 (mean ~90)
Postprandial plasma glucose* (mg/dL)	<140
A1c	4%-6%

Therapeutic goals for most patients include the following:

I. to maintain blood glucose levels as close to normal as possible without repeated episodes of hypoglycemia,
II. to strive to maintain normal body weight,
III. to control hypertension and hyperlipidemia, and
IV. to develop a flexible treatment plan that does not dominate the patient's life any more than is necessary

The patient with diabetes may be treated through control of diet and physical activity, along with administration of oral hypoglycemic agents and insulin.
In many cases of type 2 diabetes, the disease can be controlled by weight loss, diet, and physical activity.

Treatment of Patients With Diabetes Mellitus

TYPE 1 DIABETES
- Diet and physical activity
- Insulin
  - Conventional
  - Multiple injections
  - Continuous infusion
  - Pancreatic transplantation (see Chapter 22)

TYPE 2 DIABETES
- Diet and physical activity
- Oral hypoglycemic agents
- Insulin plus oral hypoglycemic agents
- Insulin

Control of hyperglycemia is beneficial in reducing diabetic neuropathy. If control of the patient's diet and physical activity fails to affect blood glucose level, hypoglycemic agents are used. Many patients with type 2 diabetes may be treated with oral hypoglycemic agents. Four classes of oral hypoglycemic agents are known.

Oral Antidiabetic (Hypoglycemic) Drugs		
Class Drug	**Daily Dose**	**Doses/Day**
SULFONYLUREAS (ENHANCE INSULIN SECRETION)		
First generation		
Chlorpropamide	100-500 mg	1
Acetohexamide	1500 mg	1
Tolazamide	100-1000 mg	1-2
Tolabutamide	500-3000 mg	2-3
Second generation		
Glipizide	5-40 mg	1-2
Glyburide	1.25-20 mg	1-2
Glimepiride	1-8 mg	1
BIGUANIDES (REDUCE HEPATIC GLUCOSE PRODUCTION)		
Metformin	1500-2500 mg	1-2
Glucovance	?	
GAMMA-GLUCOSIDASE INHIBITORS (DELAY CARBOHYDRATE DIGESTION)		
Acarbose	75-300 mg	3
THIAZOLIDINEDIONES (ENHANCE INSULIN SENSITIVITY)		
Troglitazone*	400-600 mg	1
Rosiglitazone	4-16 mg	2
Pioglitazone†	15-45 mg	1

Treatment of Type 1 Diabetes

Patients with Type 1 diabetes are treated with insulin. Insulin therapies were introduced in 1922 and for the first 60 years consisted of animal insulin obtained from bovine or porcine pancreatic extracts. Porcine insulin differs from human insulin by one amino acid and bovine insulin by three amino acids. The use of animal insulin was complicated by incomplete purification and tendency to induce the formation of anti-insulin antibodies.

In the 1980s recombinant human insulin was introduced, which resolved these issues. During the last few years insulin analogues were developed that provide advantageous pharmacokinetics. Recombinant human insulin and the newer analogues are now the main preparations used to treat Type 1 diabetes. Highly purified animal insulins are also now available.
Available human insulins and analogues include:

1- rapid-acting
2- short-acting
3- intermediate-acting
4- long-acting preparations

Treatment of Type 2 Diabetes

The management of Type 2 diabetes involves lifestyle interventions, drug therapy, and control of risk factors for cardiovascular disease. This includes control of blood glucose levels, blood pressure, lipid levels, and antiplatelet therapy as indicated. Recent evidence shows that tight control of blood glucose levels reduces the risk for microvascular (renal and retinal) and neuropathic complications of Type 2 diabetes. It has also been shown to slow the onset of macrovascular (coronary artery disease, myocardial infarction, and stroke) complications.
The monitoring of blood glucose levels and hemoglobin A1c is an important part of the management of patients with Type 1 and Type 2 diabetes.

Insulin Shock

Patients who are treated with insulin must closely adhere to their diet. If they fail to eat in a normal manner but continue to take their regular insulin injections, they may experience a hypoglycemic reaction caused by an excess of insulin (insulin shock). A hypoglycemic reaction also may be due to an overdose of insulin or an oral hypoglycemic agent. Reaction or shock caused by excessive insulin usually occurs in three well-defined stages, each more severe and dangerous than the one preceding it.
Mild Stage, Which is the most common, is characterized by;

1- Hunger
2- Weakness
3- Trembling
4- Tachycardia
5- Pallor
6- Sweating
7- Paresthesia may be noted on occasion

It occurs before meals, during exercise, and when food has been omitted or delayed.
Moderate Stage. In the moderate stage, because blood glucose substantially drops, the patient becomes incoherent, uncooperative, and sometimes belligerent or resistive; judgment and orientation are defective. The chief danger during this stage is that patients may injure themselves or someone else (e.g., if the patient is driving).

Severe Stage. Complete unconsciousness with or without tonic or clonic muscular movements occurs during the severe stage. Most of these reactions take place during sleep, also may occur after exercise or after the ingestion of alcohol after the first two stages have gone unrecognized.
Sweating, pallor, rapid and thready pulse, hypotension, and hypothermia may be present
The reaction to excessive insulin can be corrected by giving the patient sweetened fruit juice or anything with sugar in it. Patients in the severe stage (unconsciousness) are best treated with an IV glucose solution; glucagon or epinephrine may be used for transient relief.

DENTAL MANAGEMENT

Medical Considerations

A major goal in the dental management of patients with diabetes who are being treated with insulin is to prevent insulin shock during the dental appointment. Patients should be told to take their usual insulin dosage and to eat normal meals before their dental appointment, which is usually best scheduled in the morning.
The dentist should confirm that the patient has ***taken insulin and has eaten breakfast***.
The patients should be instructed to tell if they feel symptoms of an insulin reaction during the appointment. ***A source of sugar such as orange juice, cake icing, soda, or Glucola must be available in the dental office to be given to the patient if symptoms of an insulin reaction occur***.
Patients who have brittle diabetes { patients with type 1 diabetes who are being treated with large doses of insulin have periods of extreme hyperglycemia and hypoglycemia } very difficult to control or who require a high dosage of insulin (type 1 diabetes) may be at increased risk for postoperative infection.
However, prophylactic antibiotics usually are not indicated. If the patient develops an infection, appropriate systemic antibiotics may be given.
A protocol for IV sedation often involves fasting before the appointment (i.e., nothing by mouth after midnight); using only half the usual insulin dose; and then supplementing with IV glucose during the procedure. Patients with well controlled diabetes may be given general anesthesia, if necessary; however, in a dental office, management with local anesthetics is preferable.
The risk for infection in patients with diabetes is directly related to fasting blood glucose levels. If fasting blood glucose level is below 206 mg/100 mL, no increased risk is present; however, if fasting blood glucose level is between 207 and 229 mg/100 mL, the risk is increased by 20%. Additionally, if fasting blood glucose level rises to above 230 mg/100 mL, an 80% increase has occurred in the risk of infection.
Judicious monitoring and appropriate use of antibiotics must be considered in the management of these patients.
The basic aim of treatment is to simultaneously cure the oral infection and respond to the need to regain control of the diabetic condition.
Patients who are receiving insulin usually require additional insulin, which should be prescribed by their physician; non–insulin controlled patients may need more aggressive medical management of their diabetes, which may include insulin, during this period.

The dentist must treat the infection very aggressively by;

1- Incision and drainage
2- Extraction
3- Pulpotomy
4- Warm rinses
5- Antibiotics.
6- Antibiotic sensitivity testing is recommended for patients with brittle diabetes and for those who require a high insulin dosage for control.

Attention also must be paid to the patient's **electrolyte balance** and to **fluid** and **dietary needs.**

Dental Management of the Patient With Diabetes and Acute Oral Infection

1. Non–insulin-controlled patients may require insulin; consultation with physician required
2. Insulin-controlled patients usually require increased dosage of insulin; consultation with physician required
3. Patient with brittle diabetes or receiving high insulin dosage should have culture(s) taken from the infected area for antibiotic sensitivity testing
   a. Culture sent for testing
   b. Antibiotic therapy initiated
   c. In cases of poor clinical responses to the first antibiotic, a more effective antibiotic is selected according to sensitivity test results
4. Infection should be treated with the use of standard methods
   a. Warm intraoral rinses
   b. Incision and drainage
   c. Pulpotomy, pulpectomy, extractions, etc.
   d. Antibiotics

Local Anesthetics and Epinephrine

For most patients with diabetes, routine use of local anesthetic with 1:100,000 epinephrine should be tolerated well. The pharmacological effect of epinephrine is opposite to that of insulin, ***so blood glucose could rise with the use of epinephrine***. Caution may be indicated with epinephrine in diabetic patients with hypertension, post myocardial infarction, cardiac arrhythmia.

Treatment Planning Modifications

The patient with diabetes who is under good glycemic control without serious complications such as renal disease, hypertension, or coronary atherosclerotic heart disease can undergo any indicated dental treatment or even major surgeries like cardiac transplantation can be safely performed.
However, in patients with diabetes who have serious medical complications, the plan of dental treatment may need to be altered.
Elevated fasting blood glucose levels render the dental patient more susceptible to complications. Also low glucose levels (<70 mg/dl) situation must also be recognized and managed appropriately. Therefore, careful and continuous monitoring of the patient's physical status is mandatory.

Oral Complications and Manifestations

Oral complications of poorly controlled diabetes mellitus may include;

- xerostomia;
- bacterial, viral, and fungal infections (including candidiasis, and the more rare mucormycosis);
- traumatic ulcers,
- lichen planus (alteration in the immune system may be responsible for appearance of lichen planus in DM)
- poor wound healing;
- increased incidence and severity of caries;
- gingivitis and periodontal disease;
- periapical abscesses;
- and burning mouth symptoms.

Diabetic neuropathy may lead to oral symptoms of paresthesias and tingling, numbness, burning, or pain caused by pathologic changes involving nerves in the oral region. Diabetes has been associated with oral burning symptoms. Early diagnosis and treatment of diabetes may allow for regression of these symptoms, but in longstanding cases, the changes may be irreversible

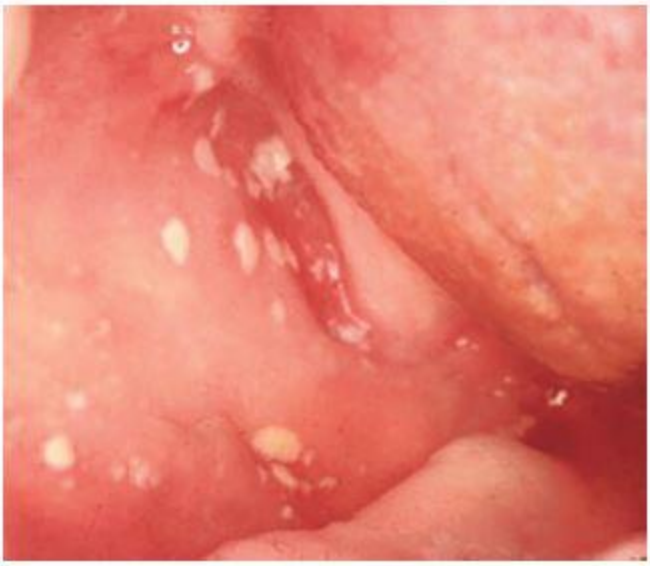

Figure 15-10. Oral moniliasis in a patient with diabetes. Note the multiple small white lesions on the buccal mucosa. The lesions could be scraped off. Cytologic study and cultures confirmed the clinical impression of infection by *Candida albicans.*

Figure 15-11. Lesion involving the palate in a patient with diabetes. Cultures established the diagnosis of mucormycosis, a serious fungal infection that may occur in patients with systemic diseases such as diabetes or cancer. Treatment usually includes control of diabetes, surgical excisions of the lesion, and administration of antibiotics and fungicides.

Oral findings in patients with uncontrolled diabetes most likely relate to;

- excessive loss of fluids through urination,
- altered response to infection,
- microvascular changes, and possibly,
- increased glucose concentrations in saliva.

The effects of hyperglycemia lead to increased amounts of urine, which deplete the extracellular fluids and reduce the secretion of saliva, thus resulting in dry mouth. A high percentage of patients with diabetes present with xerostomia. The parotid saliva of persons with uncontrolled diabetes has been reported to contain a slightly increased amount of glucose.

Dental Management of the Patient With Diabetes*

1. Non–insulin-dependent patient:
   If diabetes is well-controlled,† all dental procedures can be performed without special precautions.
2. Insulin-controlled patient:
   - If diabetes is well-controlled,† all dental procedures can be performed without special precautions.
   - Morning appointments are usually best.
   - Patient advised to take usual insulin dosage and normal meals on day of dental appointment; information confirmed when patient comes for appointment.
   - Advise patient to inform dentist or staff if symptoms of insulin reaction occur during dental visit.
   - Glucose source (orange juice, soda, Glucola) should be available and given to the patient if symptoms of insulin reaction occur.
3. If extensive surgery is needed:
   - Consult with patient's physician concerning dietary needs during postoperative period.
   - Antibiotic prophylaxis can be considered for patients with brittle diabetes and those taking high doses of insulin who also have chronic states of oral infection.

If not well-controlled (i.e., does not meet ANY of above criteria: fasting blood glucose <70 mg/dL or >200 mg/dL and ANY complications [post MI, renal disease, congestive heart failure, symptomatic angina, old age, cardiac dysrrhythmia, cerebrovascular accident], and blood pressure ≥180/110 mm Hg, or functional capacity <4 metabolic equivalents):

- Provide appropriate emergency care only.
- Request referral for medical evaluation, management, and risk factor modification
  - If symptomatic, seek IMMEDIATE referral
  - If asymptomatic, request routine referral

Detection of the Patient With Diabetes

KNOWN DIABETIC PERSON

1. Detection by history:
   a. Are you diabetic?
   b. What medications are you taking?
   c. Are you being treated by a physician?
2. Establishment of severity of disease and degree of "control"
   a. When were you first diagnosed as diabetic?
   b. What was the level of the last measurement of your blood glucose?
   c. What is the usual level of blood glucose for you?
   d. How are you being treated for your diabetes?
   e. How often do you have insulin reactions?
   f. How much insulin do you take with each injection, and how often do you receive injections?
   g. Do you test your urine for glucose?
   h. When did you last visit your physician?
   i. Do you have any symptoms of diabetes at the present time?

UNDIAGNOSED DIABETIC PERSON

1. History of signs or symptoms of diabetes or its complications
2. High risk for developing diabetes
   a. Parents who are diabetic
   b. Gave birth to one or more large babies
   c. History of spontaneous abortions or stillbirths
   d. Obese
   e. Over 40 years of age
3. Referral or screening test for diabetes

What is insulin resistance?
Insulin is a hormone produced by the beta cells of the pancreas. These cells are scattered throughout the pancreas in small clusters known as the islets of Langerhans. The insulin produced is released into the blood stream and travels throughout the body. Insulin is an essential hormone that has many actions within the body. Most actions of insulin are directed at metabolism (control) of carbohydrates (sugars and starches), lipids (fats), and proteins. Insulin also regulates the functions of the body's cells, including their growth. Insulin is critical for the body's use of glucose as energy.

Insulin resistance (IR) is a condition in which the body's cells become resistant to the effects of insulin. That is, the normal response to a given amount of insulin is reduced. As a result, higher levels of insulin are needed in order for insulin to have its proper effects, and the pancreas compensates by trying to produce more insulin. This resistance occurs in response to the body's own insulin (endogenous) or when insulin is administered by injection (exogenous).

With insulin resistance, the pancreas produces more and more insulin until the pancreas can no longer produce sufficient insulin for the body's demands, and then blood sugar rises. Insulin resistance is a risk factor for development of diabetes and heart disease.

GOOD LUCK