



The Diabetes Epidemic:

The Impact on Oral Healthcare Providers

Disclosure Statement:

- The content for this self-study course was developed and written by Carol A. Jahn, RDH, MS; a Water Pik, Inc. employee
- Water Pik, Inc. designed and produced this self-study course
- Water Pik, Inc. manufactures and distributes products addressed in this course

Course Objective:

To provide the dental team with health information and research needed to treat individuals living with diabetes and assist them in achieving good oral health.

Learning Outcomes:

- Identify reasons for the increased rate of type 2 diabetes and discuss how this increase impacts different population groups
- Differentiate between the diabetes classifications including pre-diabetes
- Describe the complications of diabetes
- Assess and screen patients for the oral and systemic signs and symptoms of diabetes
- Explain the effect of diabetes on oral health
- Discuss the impact that the periodontal infection may have on diabetes
- Explain the role of glycemic control on periodontal outcomes
- Recommend appropriate self-care to improve oral health in individuals living with diabetes

INTRODUCTION

Worldwide, 220 million people have diabetes.¹ Data indicate that global factors such as population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity will cause the number of cases of diabetes to double by the year 2030.² In the US, most recent figures (2008) indicate that 24 million people or nearly 8% of the population have the disease.³ The Centers for Disease Control (CDC) predict that if the current trends continue, 1 in 3 Americans will develop diabetes in their lifetime, and will lose on average, 10-15 years of life.⁴ As the rate of diabetes increases, it is likely that dental practitioners will treat more individuals living with this chronic and debilitating disease.

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TYPES OF DIABETES

Diabetes is a group of diseases characterized by high levels of blood glucose (hyperglycemia) resulting from defects in insulin production, insulin action or both. The type of diabetes an individual has is dependent upon the circumstances at the time of diagnosis. The diagnosis of diabetes traditionally has been based upon glucose criteria. In 2010, the American Diabetes Association included the A1C test, a reading that reflects average blood glucose over the preceding 2-3 months as one of the tests to diagnose diabetes. **Table 1** lists the types of test that may be performed in the diagnosis of diabetes. The three most common types of diagnosed diabetes are: Type 1, Type 2, and Gestational diabetes. In recent years, a new category for those at increased risk was developed. These individuals are referred to as having pre-diabetes.⁵

Table 1: Types of Tests that May be used to Diagnose Diabetes^{5*}

Test	Criteria	Comments
A1C	≥ 6.5	Fasting is not required
Fasting Plasma Glucose (FPG)	≥ 126 mg/dl	Must fast for at least 8 hours
Oral Glucose Tolerance Test (OGTT)	≥ 200 mg/dl	2 hour plasma glucose test
Random Plasma Glucose	≥ 200 mg/dl	Conducted in a patient with classic symptoms of hyperglycemia or in a hyperglycemic crisis

*Adapted from the American Diabetes Association Position Statement on the Diagnosis and Classification of Diabetes Mellitus, 2010.

Type 1

Previously called juvenile or insulin-dependent diabetes, type 1 diabetes develops when the body's immune system destroys pancreatic beta cells, the cells of the body responsible for insulin production. The cause of type 1 is not well known. It is likely that there may be a genetic predisposition as well as related environmental factors. People with type 1 must take insulin to stay alive. Type 1 accounts for about 5%-10% of all cases of diabetes.⁵ Three quarters of Type 1 cases are diagnosed in children < 18 years of age; however it can occur at any time.⁶ About 15,000 youth are newly diagnosed with type 1 each year.⁷

The onset of type 1 diabetes is often acute or mimics the flu. Symptoms of type 1 diabetes are often referred to as polyuria

(frequent urination), polydipsia (unusual thirst), and polyphagia (extreme hunger). Other symptoms include unexplained weight loss, extreme fatigue, and irritability. Diagnosis usually occurs fairly soon after the on-set of symptoms. Children with type 1 may have other autoimmune diseases such as celiac disease and autoimmune thyroiditis.⁶

Type 2

Once called adult-onset or non-insulin dependent diabetes, type 2 diabetes usually begins as insulin resistance, a disorder where cells do not use insulin properly. Over time, as the need for insulin increases, the pancreas gradually loses its ability to produce insulin. Diet, exercise, oral hypoglycemic drugs, and insulin all may be used in the treatment of type 2 diabetes. Currently, this type accounts for 90% to 95% of diabetes cases.^{6,7}

People with undiagnosed diabetes most often have type 2. The signs and symptoms of type 2 diabetes may be similar to those for type 1 but may also include frequent infections, blurred vision, cuts/bruises that are slow to heal, tingling/numbness in the hands or feet, or recurring skin, periodontal, or bladder infections. Many individuals with type 2 diabetes have no symptoms and may go undiagnosed for several years; often until other health complications appear.⁸

The risk of developing type 2 diabetes increases with age, obesity, and lack of physical activity. Type 2 is associated with family history and may be more likely to occur in those with a history of gestational diabetes or impaired glucose tolerance, now called pre-diabetes. Type 2 is more likely to occur in adults age 40 and over, but with increasing rates of childhood obesity, there are approximately 3,700 cases of type 2 in children diagnosed annually. Type 2 diabetes onset may be delayed or even prevented by lifestyle changes.⁷

Gestational Diabetes Mellitus (GDM)

Gestational diabetes has been defined as any degree of glucose intolerance with onset or first recognition during pregnancy. This type of diabetes affects about 7% of pregnancies resulting in 200,000 cases per year. Risk assessment for GDM generally occurs at the first prenatal visit. Individuals who are obese, have a history of previous GDM, or a strong family history of diabetes may be tested in the first trimester. Women of average risk are generally tested at 24 -28 weeks gestation. GDM usually resolves with delivery, however glycemic testing should be performed six weeks post partum to confirm.⁵ There has been a progressive increase (10%) in the number of women whose diabetes does not resolve after pregnancy. It is believed that they had undiagnosed type 2 diabetes prior to pregnancy not GDM.⁹

Children born to mothers with GDM are at an increased risk of having a large birth weight. They are also at risk for becoming obese, glucose intolerant, and developing diabetes in late adolescence and young adulthood. Women with GDM are more likely to develop hypertension during pregnancy and/or need a cesarean delivery.¹⁰ They also have 40%-60% chance of developing diabetes in the next 5 - 10 years.⁷

Pre-Diabetes

Pre-diabetes is the name given to the condition where individuals have glucose levels that do not meet the criteria for diabetes but are higher than those considered normal. This includes those who have an impaired fasting plasma glucose level between 100 mg/dl and 125 mg/dl or impaired glucose tolerance of 140 mg/dl to 199 mg/dl. An A1C in the range of 5.7% to 6.4% may also be considered a risk factor.⁵ It is estimated that 57 million people age 20 and over and 7% of adolescents aged 12-19 years have prediabetes.⁷ People with pre-diabetes are at higher risk for developing type 2 diabetes, although lifestyle changes can prevent or delay the onset.^{7,11} Screening for pre-diabetes is recommended for adults of any age who are overweight and/or obese and have one or more additional risk factors for diabetes. General screening for those without risk factors should begin at age 45.⁶

IMPACT OF DIABETES

Diabetes is the seventh leading cause of death in the US. It is generally thought to be underreported as the main cause of death and more likely to be recorded as a contributing cause. Overall, the risk of death for people with diabetes is twice that of those without. Both type 1 and type 2 diabetes can lead to serious complications such as those considered microvascular; retinopathy (eye disease), nephropathy (kidney disease), neuropathy (nervous system disease) and macrovascular (heart disease and stroke).⁷ These complications are a major factor in the temporary and permanent disability of a person with diabetes.¹² The cost of these complications results in medical expenditures that are 2.3 times higher than in the absence of diabetes.⁷

Health Issues

Microvascular Complications

Diabetic retinopathy refers to any abnormality of the small blood vessels of the retina such as weakening of blood vessel walls or leakage from blood vessels. It is the most frequent cause of new cases of blindness among adults aged 20 - 74 years.⁷ Nearly all individuals with type 1 diabetes and more than 60% of those with type 2 develop retinopathy within 20 years of diagnosis. Up to 21% of those with type 2 have retinopathy at the initial diagnosis.¹³ People with diabetes are 40% more likely to suffer from glaucoma and 60% more likely to develop cataracts.¹⁴ After 15 years

of having diabetes, approximately 2% become blind and 10% develop a severe visual impairment.¹

Diabetic nephropathy is a progressive disease involving damage to the blood vessels of the kidneys that act as filters to remove wastes, chemicals, and excess water from the blood. When blood vessels are damaged they allow protein to leak into the urine (called proteinuria). Diabetic nephropathy accounts for about 40% of new cases of end stage renal disease (ESRD). While about 30-40% of patients develop nephropathy, those with type 1 are more likely to progress to ESRD.¹⁵ About 10-20% of people with diabetes succumb to kidney failure.¹

Diabetic neuropathy is a form of nervous system damage often evidenced by a loss of protective sensation often afflicting the feet. About 60% of people with diabetes have mild to severe forms of nervous system damage. This can include impaired feeling in the feet or hands, slowed digestion, carpal tunnel syndrome or erectile dysfunction. Severe forms of this can lead to lower extremity amputation.⁷ The risk of foot ulcer and/or amputation is increased in people who have had diabetes for more than 10 years, are male, have poor glucose control, or have other complications; cardiovascular, retinal, or renal.¹⁶

Macrovascular Complications

Heart disease and stroke are leading causes of diabetes-related death. In 2004, heart disease was noted on 68% of diabetes-related deaths and stroke in 16% of cases. In adults with diabetes the risk for coronary heart disease (CHD) and stroke is 2 to 4 times higher than for adults without diabetes.⁷ People with diabetes are at risk of developing CHD up to fifteen years earlier than other people.¹⁷ In more than 20% of cases in people aged 50-75 years, CHD may be asymptomatic.¹⁸ Diabetes has also been shown to significantly affect mortality within thirty days after a coronary event.¹⁹

Risk factors for CHD and stroke (collectively, cardiovascular disease, CVD) are hypertension and high cholesterol. Seventy-five percent of people with diabetes have hypertension defined as blood pressure \geq 130/80 or use prescription medication to control blood pressure. In those with type 1 diabetes, hypertension may result from nephropathy.⁷ Individuals with type 2 often have lipid abnormalities as evidenced by high cholesterol, particularly a high LDL and low HDL, and high triglycerides.⁶

Other Complications

People with diabetes may be more susceptible to other illnesses, and once they acquire them, may have a worse prognosis. When they get pneumonia or influenza, they have an increased risk of dying.⁷ Emerging evidence indicates that both depression and dementia may be more likely in people with diabetes.^{20,21} People susceptible to depression seem to be those with low levels of

education, physical impairment or CVD.²⁰ People with type 2 diabetes seem to have an increased risk of both Alzheimer's disease and Vascular dementia.²¹ There are two possible ways this may happen. One theory is that neurons in the brain are affected by blood vessel damage to the brain, and blood vessel damage is a common complication of diabetes. Another pathway may relate to insulin. High insulin levels sometimes occur in people with type 2 as the pancreas pumps out higher levels of insulin in an effort to get a response in insulin resistant cells. When there is too much insulin, the body becomes overloaded with enzymes trying to break it down so that amyloid protein accumulates in the brain leading to plaque formation.²²

Disability

People with diabetes are at a greater risk of temporary incapacity and permanent disability. Disability from diabetes may prevent people from working or limit their employment opportunities.²² It has been shown to interfere with activities of daily living such as walking, climbing stairs, doing housework, and preparing meals. Older women (\geq 60 years) with diabetes had a 58% likelihood of falling compared to women without diabetes.¹²

Economic Implications

The population with diabetes tends to be older and sicker resulting in high health care costs. In the year 2007, the total estimated costs for diabetes was \$174 billion including \$116 billion in direct medical costs and \$58 billion in reduced national productivity. About \$1 for every \$10 spent on health care is attributed to diabetes, and \$1 in every \$5 is spent on caring for someone with diabetes. People with diabetes incur approximately \$11,744 in health care expenditures per year compared to \$5,095 for people without diabetes. About 50% of health care expenditures in people with diabetes are for hospital inpatient care followed by diabetes medication and supplies (12%), prescriptions for diabetic complications (11%) and physician office visits (9%).²³

Disparities Across Population Groups

Diabetes becomes more prevalent after the age of 20 affecting 10.7% of that population group. It is the most prevalent in people over 60 years of age with about 23% being affected. In the last few years, a trend shows that people are being diagnosed at earlier ages with more than half of new cases of diabetes occurring in adults between the ages of 40 and 59 years. Type 2 diabetes, while still infrequent, has also become more common among youth aged 10-19 years. Men have a slightly higher incidence than women, 11.2% versus 10.2%.

Minority groups seem to have a higher risk of developing type 2 diabetes. African American, Hispanic, American Indian, and Alaskan Native adults are twice as likely to have diabetes as Caucasians.⁴ Minority populations have been shown to develop diabetes earlier.⁷ Minority women are 2 to 4 times more likely to

have diabetes than white women. These groups are more likely to have diabetes complications that can lower quality of life.²⁴

RISK FACTORS

People who are at risk for type 2 diabetes often have a genetic predisposition. Yet in most cases an environmental trigger like being overweight or obese is also necessary.^{25,26} Not all individuals with a family history will develop diabetes nor will every overweight or obese person. From a family history perspective, the risk for developing type 2 diabetes is 1 in 7 if you have a parent diagnosed before the age of 50 and 1 in 13 if the parent was diagnosed after age 50. If both parents have type 2, the risk increases to 1 in 2.²⁵

Overweight/obese is the strongest environmental risk factor for type 2. Overweight individuals are twice as likely to develop type 2 as those of a normal weight. For those who are obese, the risk ranges from 3 to 6 times more likely depending on body mass index (BMI) (**Table 2**).²⁶

Table 2: Definitions of Weight for Adults using BMI²⁷

BMI	Classification
< 18.5	Underweight
18.5 - 24.9	Normal weight
25 - 29.9	Overweight
30 or higher	Obese

The increase in type 2 diabetes has been attributed to the growing numbers of overweight and obese individuals. The metabolic and endocrine function of adipose tissue is influenced by obesity resulting in a greater production of agents that increase insulin resistance and systemic inflammation.²⁸ A 2010 report found that 68% of US adults are overweight or obese. For men the rate is 72.3% versus 64.1% for women. However, women were more likely to be obese than men, 35.5% versus 32.2%. The overall prevalence of obesity is 33.8%.²⁹ Results from the Framingham Heart Study indicate that overweight and obesity in adulthood are associated with large decreases in life expectancy and increases in early mortality.³⁰ Obesity affects children and adolescents. Current statistics indicate that 10.4% of children ages 2-5 are obese as is 19.6% of 6-11 year olds, and 18.1% of 12-19 year olds.³⁰ Studies have found that obese children and adolescents are more likely to become obese as adults.³²

Emerging data suggests that the role of overweight/obesity is influenced by the location of weight on the body.^{33,34,35} A large waist circumference (greater than 35 inches for women and

more than 40 inches for men) means more abdominal or visceral fat, which has been shown to increase the risk of both CVD and diabetes. Waist circumference is increasing in youth at a pace faster than BMI.³⁴ Visceral fat increases the likelihood of having fat around internal organs. A recent study found that those who had the highest amount of fat in the liver were more likely to be insulin resistant.³⁶ Fat concentrated in the gluteofemoral areas of the body tends to be more passive than abdominal fat and may exert protective properties.³⁵

Another emerging risk factor for type 2 is smoking. A systematic review and meta-analysis of 25 published papers found that heavy smoking (more than 20 cigarettes per day) increased the risk of developing type 2 diabetes. The reason for this relationship has not been conclusively determined although some factors have been identified. While older studies showed that smokers tended to have lower BMIs than non smokers, a more recent investigation showed that today, smokers tend to have higher BMIs. Additionally, smokers with a normal BMI have been found to have greater abdominal fat. It is also possible that nicotine may exert a biological influence on the beta cells of the pancreas as smoking has also been shown to be a risk factor for pancreaticitis and pancreatic cancer.³⁷

PREVENTING AND CONTROLLING DIABETES AND ITS COMPLICATIONS

Type 2 diabetes can be prevented or its onset delayed through lifestyle changes. A large scale study by the Diabetes Prevention Program Research Group found that modest weight loss and physical activity were the most effective in achieving this outcome. Specifically, a 5% - 7% reduction in weight coupled with modest physical activity, about 150 minutes per week, resulted in a 58% relative reduction in the progression to type 2 diabetes. For those over 60, the reduction was even greater; 71%.⁷¹ The diabetes drug, Metformin may also be added to lifestyle changes in those who are at the highest risk of developing type 2 diabetes.⁶ Smoking cessation should also be a consideration as the risk for the development of type 2 diabetes was shown to be lower in former smokers compared to current ones.³⁷

Preventing Diabetes Complications

According to the Standards of Medical Care from the American Diabetes Association, people with diabetes need regular medical and preventive care from a physician coordinated team. The team may include (but not be limited to) nurses, pharmacists, dietitians, and mental health practitioners.⁶ Working together with these healthcare providers can reduce the occurrence of diabetes complications by controlling blood glucose, blood pressure, and lipids.⁷

Tight glucose control is regulated/obtained by using two different types of tests; daily self monitoring of glucose and the A1C reading. Daily self-management of blood glucose is useful for preventing hypoglycemia, and adjusting medication, food intake, and physical activity. Any individual that is either insulin-dependent or not achieving glycemic goals should self-monitor their blood glucose. Self-monitoring generally involves a finger-stick and is often accomplished via glucometer. Blood glucose before a meal should be between 70-130 mg/dl and less than 180 mg/dl after a meal. Those with type 1 need to test at least three times or more a day. Optimal testing for those with type 2 is not known. The accuracy of self-monitoring is user-dependent, so even those who regularly self-monitor will need to have an A1C test.⁶

An A1C test measures hemoglobin components and most accurately reflects the previous two to three months of glycemic control. The test should be routinely performed on anyone with diabetes. It is recommended at least twice a year in people meeting treatment goals and quarterly in those whose treatment has changed or are not meeting glycemic goals. The American Diabetes Association (ADA) recommends that individual patients achieve an A1C goal below or around 7%. The A1C may also be reported as an estimated glucose average or eAG. The eAG is a new way to help people understand how well they are managing their diabetes (**Table 3**).⁶

Table 3: Estimated Average Glucose^{6,38*}

A1C	eAG mg/dl	A1C	eAGmg/dl
5	97	9	212
5.5	111	9.5	226
6	126	10	240
6.5	140	10.5	255
7	154	11	269
7.5	169	11.5	283
8	183	12	298
8.5	197		

*Adapted from the American Diabetes Association

The Diabetes Control and Complications Trial and the UK Prospective Diabetes Study have shown that improved glucose control (as measured by an A1C test) is fundamental in decreasing retinopathy, nephropathy, and neuropathy. Both clinical trials found that intensive treatment regimes that were able to reduce the A1C to ~7% were associated with fewer long term microvascular complications.⁶

There have been mixed results from studies that have sought to intensively lower the A1C reading to reduce macrovascular complications. The ACCORD trial found that intensively lowering

the A1C to 6% or below increased mortality and did not reduce cardiovascular events.³⁸ A study by the ADVANCE Collaborative group found that lowering the A1C to 6.5% resulted in a 21% reduction in the risk for new or worsening nephropathy. There was no evidence of reduction of macrovascular events.³⁹

Good diabetes control also involves the management of blood pressure and lipids. Treatment goals are shown in **Table 4**. The American Diabetes Association recommends that blood pressure be measured at every routine diabetes visit. For cholesterol and triglycerides, testing is recommended yearly for those with levels not within normal limits; for others, testing is recommended every two years.⁷

Table 4: Recommendations for Adults with Diabetes⁷

Test	Result
A1C	• < 7%
Fasting blood glucose	• 90-130 mg/dl
Non-fasting blood glucose	• < 180 mg/dl
Blood pressure	• < 130/80 mm/Hg
Lipids	
• LDL	• < 100 mg/dl
• HDL	• > 50 mg/dl for women
	• > 40 mg/dl for men
• Triglycerides	• < 150 mg/dl

DIABETES AND ORAL HEALTH

Diabetes can have many oral manifestations and complications that can impact the quality of life and potentially the length of life.^{28,40,41,42,43,44} It increases both the risk and severity of periodontal disease.²⁸ Xerostomia is very common and may be debilitating, and/or increase the risk for fungal infections and/or caries.⁴⁰

Xerostomia

Dry mouth in patients with diabetes can result from a variety of causes including metabolic control, endocrine function, and medications.^{40,44} Xerostomia can range from a feeling a dryness to difficulty speaking or swallowing without the aid of liquid.⁴⁵ It can increase the risk for caries especially root caries in older patients. Xerostomia along with poor metabolic control and a compromised immune system can create the ideal environment for fungal infections. Burning mouth syndrome has been found in undiagnosed cases of type 2 diabetes. Lichen planus has been observed to occur more frequently in people with diabetes.⁴⁰

Periodontal Disease

Diabetes is a well-established risk factor for gingivitis and periodontal disease, and those with poor glycemic control seem to be at the highest risk. Both adults and children with poor glycemic control have been shown to have more bleeding and inflammation than those with good control.^{28,43} Periodontal destruction can begin early in life for children with diabetes and may become more pronounced into adolescence. Children as young as 6-11 years have been shown to have teeth with attachment loss and the incidence was even higher in those 12-18 years old.⁴³ For adults, the data indicates that as glycemic control worsens there tends to be deeper periodontal pockets and more severe attachment and bone loss.²⁸

Periodontal destruction can begin early in life for children with diabetes and may become more pronounced into adolescence.⁴³

Although evidence is limited, it appears that people with poorly controlled diabetes do not respond as well to treatment in the long term as people with good or even moderate control. Patients may not respond to therapy or there may be an initial response followed by a rapid reoccurrence of deep pocketing. Conversely, over a five year period, people with good or moderate control who received non surgical and surgical therapy followed by regular maintenance had outcomes similar to people without diabetes.²⁸

The Influence of Periodontal Disease on Diabetes

Several studies have evaluated the effect that the periodontal infection has on diabetes control and/or complications. Periodontal disease has been shown to significantly (6-fold) increase the likelihood of poor glycemic control over time.⁴⁵ The presence of severe periodontal disease has also been associated with more serious complications including an increased risk for mortality from those complications.^{41,42,46} Saremi et al found that severe periodontal disease was a strong predictor of mortality from both ischemic heart disease and diabetic nephropathy in a Pima Indian population with type 2 diabetes.⁴¹ Likewise, Shultis showed that severe periodontal disease predicted the development of overt nephropathy and end stage renal disease, also in the same population with type 2 diabetes.⁴²

The periodontal infection triggers low level inflammation that leads to increased cytokine production. Researchers have theorized that this increase may contribute to the total systemic inflammatory burden.⁴⁷ One cytokine, TNF- α is often elevated with periodontal disease and has been shown to play a role in insulin resistance.²⁸ To substantiate this theory, studies have looked at the effect of periodontal therapy on glycemic control. An early study showed that a combination of aggressive non surgical therapy and an antibiotic regime of systemic doxycycline, 100 mgs for two weeks, helped control the periodontal infection and reduce the level of glycated hemoglobin for three months post treatment. By six months, A1C levels had returned to baseline reading.⁴⁸ A meta-analysis of 10 studies that looked at periodontal treatment and glycemic control found that overall the reduction in A1C to be non significant. The investigators noted that many confounding effects such as smoking, BMI, and diet, play a role in glycemic control and this may have had an influence on outcomes.⁴⁷

MANAGING THE PATIENT WITH DIABETES

A thorough medical history and oral exam are the primary steps in assessing any individual seeking care. This is critical for screening individuals who may be undiagnosed or at-risk for diabetes as well as planning treatment for those with diagnosed diabetes. Knowledge of disease type, duration, level of control, and complications can help determine appropriate periodontal therapy and maintenance.⁴⁹

A good medical history will ask about the signs and symptoms of undiagnosed diabetes as well as gather information pertinent to the treatment of someone with diabetes. Oral conditions in an individual with undiagnosed diabetes can include pronounced edematous gingival enlargement of unexplained cause, multiple or recurrent periodontal abscesses, rapid bone destruction, or delayed healing. When these conditions are present with or without corresponding signs/symptoms noted in the medical history, a medical consultation may be warranted.⁴⁹

For those with diagnosed diabetes, it is important to include information related to disease type, duration, medication type and frequency of use, use of self-monitoring and frequency, latest A1C tests, and history of complications in addition to other traditional information gathered on the medical history.⁴⁹ The medical history must be updated at each appointment. Since many individuals with type 2 diabetes may go undiagnosed for long periods of time, asking about duration of disease in addition to date of diagnosis can provide more meaningful information since periodontal complications are associated with disease duration. Type of medication and frequency of use are critical so that scheduling can be done to avoid periods when the risk



Figure 1: Waterpik® Ultra Water Flosser, Model WP-100W; comes with the Classic Jet Tip, Plaque Seeker™ Tip, Pik Pocket™ Tip, Orthodontic Tip, Tongue Cleaner, and Toothbrush Tip.



Figure 2: Waterpik® Cordless Plus Water Flosser, Model WP-450W; comes with the Classic Jet Tip, Plaque Seeker™ Tip, Orthodontic Tip, and Tongue Cleaner.

The most common medical emergency that occurs in people with diabetes is hypoglycemia. Hypoglycemia generally occurs in those using insulin but can occur with oral agents. People at the greatest risk for hypoglycemia are the ones with the lowest A1C (<7%). Symptoms of hypoglycemia can start with blood glucose readings around 60 mg/dl although as more patients achieve tighter glucose control, hypoglycemia can occur without symptoms (Table 5).⁵⁰ Conscious patients can be treated with 4 ounces of a sugar sweetened beverage or three glucose tablets. For people that lose consciousness, call for emergency help. Do not inject insulin, glucagon or try to provide food or fluids.⁵¹ Hypoglycemia can be avoided by reminding individuals to maintain a normal eating schedule and taking their medication on schedule. Another preventive measure is to ask patients to bring their glucometer to the appointment. With a glucometer, testing can take place before dental treatment begins. In some instances, depending on the blood glucose reading, length of appointment time, it might be beneficial to provide the patient with an oral carbohydrate prior to the start of treatment.⁵⁰

of hypoglycemia is high. In addition to asking people about glycemic control, copies of the most current A1C test should be reviewed before a treatment plan is developed since level of control may influence treatment outcomes.⁴⁹ Knowledge of complications can help the dental professional better understand the medical, social, and societal aspects of living with diabetes.

Treatment

Before providing non-surgical or surgical therapy on an individual with diabetes or scheduling for a long appointment, a medical consultation should be considered. It is important for practitioners to have an A1C reading taken within the last three months and to have a current, chairside blood glucose reading. The A1C can help predict long-term treatment prognosis and the current blood glucose reading can help avoid patient emergencies.^{28,49,50}

Table 5: Symptoms of Hypoglycemia⁵¹

- Confusion
- Shakiness
- Dizziness or light-headedness
- Mood or behavior change
- Paleness
- Hunger
- Perspiration
- Clumsy or jerky movements
- Tingling sensation around the mouth
- Seizure



Figure 5: Reduction of gingival bleeding compared to string floss⁵³



Figure 6: Reduction of gingival bleeding at 14 days⁵⁵



Figure 7: Orthodontic Tip



Figure 8: Reduction of plaque versus string floss⁵⁴

Maintenance

Like anyone treated for periodontal disease, people with diabetes should have periodontal maintenance visits at close intervals (2 - 3 months).⁴⁹ In a five-year study, those with good or moderately controlled diabetes who had regular maintenance visits showed similar percentages of stable sites as well as those gaining or losing attachment as compared to those without diabetes.²⁸ Tobacco cessation therapy should continue to be recommended for those in need.⁴⁹

Meticulous self-care is important for all individuals with diabetes. The only self-care device tested specifically on individuals with diabetes and found safe and effective is the Waterpik® Water Flosser (Water Pik, Inc., Fort Collins, CO) (Figures 1 & 2).⁴⁰ Study results showed adding the Water Flosser was superior to normal oral hygiene in reducing the traditional measures of periodontal disease; 44% more effective at reducing bleeding and 41% more effective at reducing gingival inflammation (Figures 3 & 4). The Water Flosser also reduced the serum levels of the pro-inflammatory cytokines IL-1 β and PGE₂, as well as the level of reactive oxygen species.⁵²

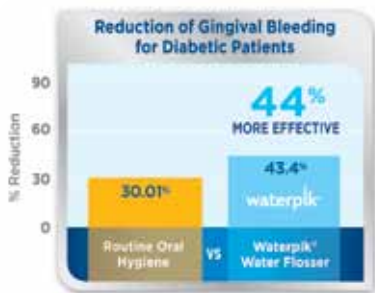


Figure 3: Reduction of gingival bleeding in patients with diabetes⁵²



Figure 4: Reduction of gingival inflammation in patients with diabetes⁵²

All patients, especially patients with diabetes, need some type of interdental care. The Waterpik® Water Flosser is clinically proven to be an easier, more effective alternative to string floss. Three studies with three different types of tips have compared the Water Flosser to string floss. In each study, the Water Flosser provided superior results over string floss for reducing gingival bleeding (Figures 5 & 6).^{53,54,55} The Orthodontic Tip (Figure 7) was three times more effective at removing plaque than string floss and five times more effective than brushing alone (Figure 8).⁵⁴ Both the Classic Jet Tip (Figure 9) and the Plaque Seeker™ Tip (Figure 10), when compared to string floss, have removed plaque similarly, with no significant differences shown.^{53,55}

Another recent study with the Water Flosser was undertaken at the University of Southern California Center for Biofilms. The investigators evaluated the effect of a three-second pulsating (1,200 per minute) lavage at medium pressure on plaque biofilm using scanning electron microscopy (SEM). The results showed that the Water Flosser with the Classic Jet Tip removed 99.9% and the Orthodontic Tip 99.8% of biofilm (Figures 11 & 12). The researchers concluded that the hydraulic forces produced by the Water Flosser with 1,200 pulsations at medium pressure can significantly remove plaque biofilm from treated areas of tooth surfaces.⁵⁶

Conclusion

The rise in the number of people with diabetes will be a challenge to all health care providers, including dental practitioners. In addition to oral considerations, especially periodontal disease, dental professionals will be called upon to treat individuals with significant medical complications and physical limitations. Coordination of care via medical consultation, treatment needs, frequent maintenance, and evidence-based self-care can enhance the delivery of care. New information regarding the treatment of diabetes is available on a daily basis.



Figure 9: Classic Jet Tip



Figure 10: Plaque Seeker™ Tip



Figure 11: Before Treatment



Figure 12: After a 3-second treatment with the Waterpik® Water Flosser

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POST TEST COURSE #10-14

The Diabetes Epidemic: The Impact on Oral Healthcare Providers

1. **24 million or ____ percentage of the US population has diabetes.**
 - a. 4
 - b. 6
 - c. 8
 - d. 10
2. **Most people with diabetes have type 1; Cases of type 2 are responsible for the biggest increase in the number of people with diabetes.**
 - a. Both statements are true
 - b. The first statement is true; the second is false
 - c. The first statement is false; the second is true
 - d. Both statements are false
3. **Type 2 diabetes is twice as likely to occur in:**
 - a. African Americans
 - b. Hispanic Americans
 - c. Native Americans
 - d. All of the above
4. **Prediabetes affects an estimated 57 million US adults; Prediabetes puts a person at a higher risk of developing diabetes.**
 - a. Both statements are true
 - b. The first statement is true; the second is false
 - c. The first statement is false; the second is true
 - d. Both statements are false
5. **Risk factors for type 2 diabetes are:**
 - a. Family history
 - b. Overweight/Obesity
 - c. Smoking
 - d. All of the above
6. **People with diabetes develop heart disease about 15 years sooner than others; Heart disease is a leading cause of death for those with diabetes**
 - a. Both statements are true
 - b. The first statement is true; the second is false
 - c. The first statement is false; the second is true
 - d. Both statements are false
7. **The microvascular complications of diabetes include:**
 - a. Retinopathy
 - b. Nephropathy
 - c. Neuropathy
 - d. All of the above
8. **People with periodontal disease and poor glycemic control have been shown to have:**
 - a. More bleeding and inflammation
 - b. Deeper periodontal pockets
 - c. A level favorable with long term prognosis
 - d. All of the above
9. **Before beginning treatment on a patient with diabetes, the results of an A1C test conducted within the last _____ months should be reviewed**
 - a. 1 month
 - b. 3 months
 - c. 12 months
 - d. 24 months
10. **The only self care device tested on people with diabetes is:**
 - a. Power toothbrush
 - b. Power flosser
 - c. Water Flosser
 - d. Tongue cleaner
11. **The most common medical emergency that occurs in people with diabetes is hyperglycemia. Symptoms generally start when blood glucose drops below 60 mg/dl.**
 - a. Both statements are true
 - b. The first statement is true, the second statement is false
 - c. The first statement is false, the second statement is true
 - d. Both statements are false
12. **Signs/symptoms of hypoglycemia may include:**
 - a. Dizziness
 - b. Confusion
 - c. Perspiration
 - d. All of the above
13. **When treating a patient with diabetes, it is important to know:**
 - a. How long they have had diabetes
 - b. The medications they take
 - c. History of diabetes complications
 - d. All of the above
14. **The onset of type 2 diabetes can be delayed; Type 2 diabetes cannot be prevented.**
 - a. Both statements are true
 - b. The first statement is true, the second is false
 - c. The first statement is false, the second statement is true
 - d. Both statements are false
15. **Gestational diabetes is defined as the development of diabetes while pregnant. It does not resolve with delivery.**
 - a. Both statements are true
 - b. The first statement is true, the second statement is false
 - c. The first statement is false, the second statement is true
 - d. Both statements are false



CE REGISTRATION FORM AND ANSWER SHEET

Course # 10-14: The Diabetes Epidemic: The Impact on Oral Healthcare Providers

Name: _____

Credentials: _____

Street Address: _____

City: _____

State: _____ Zip: _____

Daytime Phone: _____ Mobile or Hm: _____

Email: _____

Answer Sheet

Please circle the correct answer for each question.

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

Course Evaluation

Circle your response: 1 = lowest, 5 = highest

Course objectives were met
1 2 3 4 5

Content was useful
1 2 3 4 5

Questions were relevant
1 2 3 4 5

Rate the course overall
1 2 3 4 5

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