



The Diabetes Epidemic:

THE IMPACT ON ORAL HEALTHCARE PROVIDERS

Disclosure Statement:

- This course was designed, developed and produced by Water Pik, Inc.
- 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

In the US and worldwide, the rate of diabetes is rising. A recent study indicates that by the year 2030, globally, the number of people with diabetes will double.¹ In the US alone, 20.8 million people or 7% of the population have the disease.² The rise is expected to continue. It is predicted that children born in the year 2000 will have a one in three chance of developing diabetes. This trend will impact dental professionals. It is currently estimated that about 5% of all individuals seen in a dental office have diabetes. Depending on age or population group, this rate could be as high as 20% - 25%. As diabetes increases, dental practitioners will treat more individuals living with the disease.

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DIABETES: A NATIONAL HEALTH PROBLEM

Of the more than 20 million people in the US with diabetes, 5% - 10% have type 1 diabetes. The majority of individuals living with diabetes have type 2. Type 2 diabetes accounts for most of the increase in diabetes cases.² The rise in this chronic, incurable disease can be attributed to several different factors. Type 2 is most common after the age of 60 so as the population ages and people live longer, more people have diabetes.¹ Importantly, overweight and obese combined with physical inactivity are significant predictors for type 2 diabetes.^{1,3,4}

Obesity

Statistics from The National Institute of Diabetes and Digestive and Kidney Diseases indicate that less than one third of US adults have a healthy weight.⁴ About two thirds are considered overweight/obese with about 32% considered obese. The increase in overweight and obese affect both genders, all age groups, all racial/ethnic groups, all educational levels, and all smoking levels.⁵ Seventeen percent of children and adolescents are overweight while 33.6% are considered at-risk for overweight.^{4,6} 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.⁷

The epidemic of obesity is largely attributed to increased calorie intake. Americans eat 15% more calories than in the past.⁸ A sedentary lifestyle is a contributing factor. Less than one third of US adults engage in vigorous physical activity three or more times per week. Fifty-nine percent report no vigorous physical activity at all.⁴

Being overweight or obese increases the risk for type 2 diabetes by 3.35 and 6.16 respectively.⁵ Type 2 no longer only affects adults. As obesity rates increase during youth, children, adolescents, and young adults are developing type 2 diabetes. There are racial and ethnic disparities; particularly with African American, Hispanic/Latino Americans, and Native Americans.^{2,9}

Disparities Across Population Groups

Previously, type 2 diabetes occurred after the age of 40 and was most often seen in people > 60 years. While the highest rate still occurs in senior citizens, people are being diagnosed at earlier ages. Statistics show that in 2002, more than half (50.8%) of all adults with diabetes reported being diagnosed between the ages of 40 and 59 years. A substantial number, 27.4% reported a diagnosis that occurred < 40 years. For the 60-79 age group, the rate of diagnosis was 21.8%.⁷ The impact of these numbers is that while the estimate for individuals

with diabetes is 7% across age demographics, the rate for the group age 20 and older is 9.6% and for those age 60 and over, it is 20.9%.²

Data indicates that type 2 diabetes occurs more frequently in African Americans, Hispanic and Latino Americans, and Native Americans than non-Hispanic whites.² Some reports indicate that in these population groups, type 2 diabetes may reach as high as 25% for individuals over the age of 45 years.³ Between 2002 and 2010, the number of people diagnosed with type 2 diabetes is expected to double in the Hispanic population and increase by 50% for African Americans compared to a 27% increase for non Hispanic whites.⁷ In addition to adults, minority adolescents are impacted.³ Some studies indicate that the increase in minority youth is directly related to increases in childhood obesity.⁹ Table 1 breaks down diabetes rates by age, gender, and population group.

Table 1: Prevalence by Age, Gender, Race/Ethnicity in those ≥ 20 years of age²

Population Group	Percentage	Number Affected
Age 20+	9.6%	20.6 million
Age 60+	20.9%	10.3 million
Men	10.5%	10.9 million
Women	8.8%	9.7 million
Non Hispanic whites	8.7%	13.1 million
Hispanic/Latino Americans	9.5%	2.5 million
African Americans	13.3%	3.2 million
Native Americans	15.1%	118,000

Economic Costs

Diabetes is the sixth leading cause of death in the US.² In the year 2002, direct medical and indirect expenditures attributable to diabetes were \$132 billion or \$1 for every \$10 spent on health care. People with diabetes incur approximately \$13,243 in health care expenditures per year compared to \$2,560 for people without diabetes. It is likely this number is underestimated because it omits intangibles such as pain, suffering, and care provided by non-paid caregivers as well as other areas of health care spending including dental care and school-based and public health clinics. Including dental care could raise the estimate by at least \$60 million. Medical expenditures are greatest for in-patient stays, followed by nursing home care and physician office visits.¹⁰

People with diabetes are at a greater risk of temporary incapacity, permanent disability, and premature death. In 2002, there were 176,000 cases of permanent disability attributable to diabetes. Permanent disability results in an average loss of

earnings of about \$42,462 per year. Diabetes is a factor in 18% of home health visits, 15% of nursing home services, and 15% of hospice care services.¹⁰ Diabetes may interfere with activities of daily living such as walking, climbing stairs, doing housework, and preparing meals. Older women (> 60 years) with diabetes had a 58% likelihood of falling compared to women without diabetes.¹¹

DIABETES CLASSIFICATIONS

Diabetes is a group of diseases characterized by high levels of blood glucose (hyperglycemia) resulting from defects in insulin production, insulin action or both. Diabetes is classified as type 1 or type 2. A new term, pre-diabetes, was recently implemented to identify those with impaired glucose tolerance as this condition indicates a high risk for developing type 2 diabetes. Gestational diabetes may occur in some women during pregnancy, generally resolving upon delivery.¹²

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. People with type 1 must take insulin to stay alive. Type 1 diabetes generally strikes children and young adults, though it can occur at any age. Approximately one in every 400-600 children and adolescents has type 1 diabetes. It accounts for approximately 5% - 10% of diabetes.^{2,12}

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. A combination of genetics and environmental triggers are being studied as potential causes of this disease. Children with type 1 may have other autoimmune diseases such as celiac disease and autoimmune thyroiditis.¹³

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.^{2,12}

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.^{14,15}

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 diabetes is not curable but the onset may be delayed or even prevented by lifestyle changes^{14,15}

Pre-Diabetes

Pre-diabetes is the name given to the condition called impaired glucose tolerance. In this state, glucose levels are not consistent with a diagnosis of type 2 diabetes, but are too high to be considered normal. This includes those who have a fasting plasma glucose level between 100 mg/dl and 126 mg/dl.^{14,15} It is estimated that 54 million Americans including 2 million adolescents have pre-diabetes.¹⁶

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People with pre-diabetes are at higher risk for developing type 2 diabetes; however progression is not inevitable. Several studies have been conducted on the prevention or delay of type 2 diabetes. Most findings are consistent in that a 5% - 7% reduction in weight coupled with an increase in modest physical activity, about 150 minutes per week, can significantly reduce the risk of developing type 2 diabetes. In the Diabetes Prevention Program trial, weight loss and exercise resulted in a 58% relative reduction in the progression to type 2 diabetes. Other factors shown to be effective included reducing fat intake, particularly saturated fat, and increasing fiber intake. No side effects were noted in any of the trials. Screening for pre-diabetes is recommended for individuals overweight and > 45 years.¹⁵

Gestational Diabetes Mellitus (GDM)

Gestational diabetes is 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 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.¹⁷ Five to ten percent of women with gestational diabetes are found to have type 2 diabetes after delivery. They also have a 20% - 50% chance of developing diabetes in the next 5 - 10 years.² Children of women who had GDM are at an increased risk of obesity, glucose intolerance, and diabetes in late adolescence and young adulthood.¹⁷

DIABETIC COMPLICATIONS

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). These complications are a major factor in the temporary and permanent disability of a person with diabetes. Preventive care, including controlling blood glucose, blood pressure, and blood lipids can reduce their occurrence.²

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. Nearly all individuals with type 1 diabetes and more than 60% of those with type 2 diabetes develop retinopathy within 20 years of diagnosis. Up to 21% of those with type 2 have retinopathy at the initial diagnosis. Glaucoma, cataracts, and corneal disease are common also and may contribute to blindness.¹⁸

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 the blood vessels are damaged they allow protein to leak into the urine (called proteinuria). While it takes many years to develop, this damage leads to end stage renal disease (ESRD), where dialysis or kidney transplant is required. Diabetes is the leading cause of ESRD. Risk of ESRD is about 12 times higher in those with type 1 versus type 2. The incidence of ESRD is 4 to 6 times higher in the African American, Mexican American, and Native American population with diabetes than others with diabetes.¹⁹

Diabetic neuropathy is a form of nervous system damage often evidenced by a loss of protective sensation afflicting the foot. The most common consequences of this is risk of foot ulcers and amputation, which are the major causes of morbidity and disability in people with diabetes.²⁰ More than 60% of non traumatic lower limb amputations occur in people with diabetes. Neuropathy also may result in impaired sensation or pain in

the hands, carpal tunnel syndrome, slowed digestion, and other nerve problems.²

Macrovascular Complications

Coronary heart disease (CHD) is the leading cause of diabetes-related death. Nearly 65% of deaths among people with diabetes are due to CHD or stroke. In adults with diabetes the risk for CHD death and stroke is 2 to 4 times higher than for adults without diabetes.² A recent study found that people with diabetes are at risk of developing CHD up to fifteen years earlier than other people.²¹ In more than 20% of cases, CHD may be silent.²² Diabetes has also been shown to significantly affect mortality within thirty days after a coronary event.²³

Risk factors for CHD are hypertension and high cholesterol. The majority of people with diabetes have hypertension defined as blood pressure > 130/80. In those with type 1 diabetes, hypertension may result from nephropathy. Individuals with type 2 often have lipid abnormalities as evidenced by high cholesterol, particularly a high LDL and low HDL, and high triglycerides.¹⁵

Preventing Complications

Glucose control is generally measured by a test called the A1C, also called the HbA1c. 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 recommends that individual patients achieve an A1C goal as close to normal (6%) as possible without significant hypoglycemia.¹⁵

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. It is possible that a more stringent reduction (<6%) may further reduce complications.¹⁵

Daily self-management of blood glucose is another component of diabetes control. It 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. 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.¹⁵

Good diabetes control also involves the management of cardiovascular disease risk factors. Blood pressure, cholesterol, and triglyceride goals are shown in Table 2. 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. Individuals with diabetes who smoke are advised to quit.¹⁵

Table 2: Recommendations for Adults with Diabetes²⁰

Test	Result
A1C	< 7% for patients in general < 6%; for the individual patient
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	• > 40 mg/dl
• Triglycerides	• < 150 mg/dl

THE RELATIONSHIP BETWEEN DIABETES AND ORAL HEALTH

Diabetes can have many oral manifestations. It is generally accepted that diabetes increases the risk of periodontal disease. Xerostomia is common. Concurrently, individuals may experience taste disturbances, burning mouth syndrome, candidiasis infection, or oral mucosal diseases such as lichen planus or recurrent aphthous stomatitis. Dry mouth may also increase the risk for dental caries. Interestingly, no clear association between diabetes and dental caries has been found as some studies have shown an increased rate while others have demonstrated similar or lower caries incidence.^{24,25}

Diabetes Influence on Periodontitis

Diabetes appears to increase both the risk and severity of periodontal disease, particularly for individuals who are not achieving good glycemic control. Duration of diabetes also seems to play a role. The incidence of periodontal diseases increases after puberty and with age. These increased levels of susceptibility have not been correlated with an increase in plaque or calculus. Children with diabetes have been shown to have more inflammation than peers without diabetes with no difference in plaque measures.²⁵ A recent study found that periodontal destruction can begin early in life for children with diabetes and may become more pronounced into adolescence.²⁶

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Individuals with poor glycemic control often experience the worst periodontal health. This is evidenced by severe gingival bleeding, greater probing depths and greater attachment and bone loss. Periodontal disease often manifests and progresses similar to the other complications of diabetes. Those living with diabetes with good glycemic control may have good periodontal health. There are exceptions in both cases generally dependent upon the presence or absence of other independent risk factors for periodontal disease such as genetics or smoking²⁴

The Influence of Periodontal Disease on Diabetes

A recent focus on the link between diabetes and periodontal disease has been to evaluate the effect that the periodontal infection has on glycemic control. Taylor et al demonstrated that severe periodontal disease significantly (4-fold) increased the likelihood of poor glycemic control.²⁷ Another study showed that people with severe periodontal disease and diabetes had more renal disease and cardiovascular complications, including stroke, transient ischemic attacks (TIA), angina, myocardial infarction and intermittent claudication than people with diabetes and little or no periodontal disease.²⁸ Recently, Saremi et al found that 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.²⁹ Likewise, Shultis showed that periodontal disease predicted the development of overt nephropathy and end stage renal disease, also in people with type 2 diabetes.³⁰

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One emerging theory is that the periodontal infection triggers low level inflammation that leads to increased cytokine production and insulin resistance.³¹ Individuals with diabetes have been shown to express significantly higher levels of PGE₂ (4.2-fold), TNF α (4.6-fold), and IL-1 β (4.2-fold) as compared to individuals without diabetes.³² TNF α is a pro-inflammatory cytokine that has been shown to play a role in insulin resistance.³¹

To substantiate this hypothesis, studies have looked at the effect of periodontal therapy on the level of glycemic control. In a recent literature review, Gutske concluded that there are a few studies that suggest that periodontal therapy may improve glycemic control; however the magnitude and duration of improvement may not be clinically significant.³³ One study by Grossi et al incorporated systemic antibiotics into the methodology and had promising outcomes. Conducted on a Native American population (Pima Indians of the Gila River Indian Community in Arizona), the investigators found 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 glycosylated hemoglobin for three months post treatment. This reduction was short-term. By six months, A1C levels had returned to baseline reading.³⁴

MANAGEMENT OF THE INDIVIDUAL 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.³⁵

Assessment

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.³⁵

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.³⁵ 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 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.^{25,36} Knowledge of complications can help the dental professional better understand the medical, social, and societal aspects of living with diabetes. Importantly, the American Diabetes Association advocates that individuals with diabetes have their blood pressure monitored at all medical visits. This seems a wise recommendation for dental visits as well. In addition to blood pressure, the latest cholesterol reading should be noted.¹⁵

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.^{25,36}

The goal for many individuals with diabetes, particularly those taking insulin is tight or intense control meaning that insulin is given more frequently either via injections or a pump. The downside to this is that the individual is at greater risk for hypoglycemia, also called insulin shock.³⁶ This is an important consideration for scheduling. Rather than assume that morning is the best appointment time, it is preferable to ask the individual about the most ideal time to avoid periods of peak insulin activity.²⁵ Likewise, the office can assist in avoiding hypoglycemia by implementing treatment in a timely fashion after the individual has arrived at the dental office.

The most common medical emergency that occurs in people with diabetes is hypoglycemia. This occurs when the blood glucose level falls below 50 mg/dl. Hypoglycemia can develop rapidly and should be treated immediately with glucose or carbohydrate-containing foods such as four ounces of fruit juice, or regular soft drink, one to two teaspoons of honey or two to three glucose tablets. Hypoglycemia can be avoided by reminding individuals to maintain a normal eating schedule before the appointment and by bringing their glucometer to the appointment. With a glucometer, testing can take place before

dental treatment begins. Anyone with a reading of 70 mg/dl or less may benefit from consuming an oral carbohydrate prior to treatment. Additionally, the practitioner should ask the individual to show them how to use the glucometer so if an emergency occurs a blood glucose reading can be taken. Table 3 highlights the signs and symptoms of hypoglycemia.³⁷

Table 3: Signs and Symptoms of Hypoglycemia³⁷

- | | |
|---------------------------------|----------------------------|
| • Confusion | • Difficulty speaking |
| • Perspiration | • Nervousness or shakiness |
| • Hunger | • Sleepiness |
| • Dizziness or light-headedness | • Feeling anxious or weak |

In addition to increasing the severity of periodontal disease, poor glycemic control, or hyperglycemia, can affect treatment outcomes. While the initial response to therapy may be good, it has been observed that those with poor glycemic control have a greater reoccurrence of deep probing depth and a less favorable long-term response. For those whose disease is well controlled, response to therapy appears to be similar to that of individuals without diabetes. Therefore, knowing the individual's A1C reading is integral to assessing prognosis and developing treatment plans.²⁵

The American Diabetes Association recommends that all individuals with diabetes who smoke be advised to quit and that smoking cessation counseling be a routine component of care. When people with diabetes smoke, they further increase their risk for both cardiovascular disease and periodontal disease.¹⁵ While smoking cessation programs may seem to be beyond the scope of many dental practices, a program developed by the American Dental Hygienists' Association provides an easy way for most offices to direct individuals to smoking cessation programs. Called "Ask, Advise, Refer." the program encourages dental hygienists to ask patients about tobacco usage, advise them to quit, and refer them to a state or national quit-line for cessation counseling.³⁸ Quit-lines have been developed in the past few years and have shown to be effective in helping people stop using tobacco products.³⁹

Maintenance

Like anyone treated for periodontal disease, people with diabetes should have periodontal maintenance visits at close intervals (2 - 3 months).^{33,35,36} 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.^{24,25,33} Tobacco and appropriate cessation therapy should continue to be recommended for those in need.¹⁵

Meticulous self-care is important for all individuals with diabetes.³⁵ The only self-care device tested specifically on individuals with diabetes and found safe and effective is the Waterpik® dental water jet (Water Pik, Inc, Fort Collins, CO).⁴⁰ (Photos 1, 2, 3) Study results showed that individuals with diabetes who added a dental water jet to routine brushing and flossing had better improvements in both periodontal and systemic measures, including a 44% reduction in bleeding and reductions in serum IL-1 β , PGE₂, and reactive oxygen species over routine oral hygiene alone.⁴⁰ This is consistent with the body of evidence on the dental water jet. In addition to pro-inflammatory mediators,⁴¹ studies conducted on the dental water jet have demonstrated the effective reduction of gingivitis, bleeding, and periodontal pathogens.⁴² A dental water jet is the ideal vehicle for at-home delivery of antimicrobials due to enhanced subgingival access.^{43,44} The Waterpik® continuing education course, The Dental Water Jet: The Key to Optimal Oral Health addresses the comprehensive body of research on this product; visit www.waterpik.com.

People with diabetes may benefit from the use of a power toothbrush and an interdental cleaner. There are several power brushes on the market with a wide array of features, which can

influence acceptance of the product. Many have been shown to reduce biofilm (plaque), gingivitis, and stain superior to a manual brush. (Photo 4) One study found that three popular types of power toothbrushes (Waterpik® Sensonic® Professional Toothbrush, Water Pik, Inc, Fort Collins, CO, Sonicare® Elite, Philips Oral Healthcare, Snolquamie, WA and Oral-B® Sonic Complete, Procter & Gamble, Cincinnati, OH) and one manual brush to provide significant plaque removal (Table 3).⁴⁵

Table 4: Percent improvements in plaque reduction*

Toothbrush Type	Whole Mouth	Marginal	Approximal
Waterpik® Sensonic® Toothbrush (SR1000)	89%	81%	97%
Oral-B® Sonic Complete Toothbrush	82%	72%	91%
Sonicare® Elite (7800)	75%	62%	86%
Oral-B® Indicator (Soft Compact 35)	78%	66%	87%

Dental floss has long been the primary self-care recommendation made by most dental professionals. Yet the number of people who floss on a regular basis continues to remain low. Practitioners sometimes have concerns that alternatives to manual floss can never be as effective as traditional floss-



Photo 1: Waterpik® Ultra Dental Water Jet, Model WP-100W. Includes 3 jet tips, three tongue cleaners, one Pik Pocket® tip, an orthodontic tip.



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Photo 2: Waterpik® Ultra Cordless Dental Water Jet, Model WP-450W. Comes with jet tip, Pik Pocket® tip, Orthodontic tip, and tongue cleaner.

ing. Research contradicts this assumption. Several studies have shown that alternatives to manual floss, such as flossing with a floss holder, interdental brushes, power flossers, and dental water jets can be just as effective at reducing biofilm, gingivitis, and bleeding as manual floss.⁴⁶ A currently available power flosser (Waterpik® power flosser, Water Pik, Inc, Ft. Collins CO) (**Photo 5**) has been demonstrated to remove biofilm and reduce bleeding and gingivitis similar to manual floss.^{47,48} Two studies have shown the dental water jet to be an effective alternative to dental floss. A study at the University of Nebraska found that the Waterpik® dental water jet reduced bleeding, gingivitis and plaque as well as traditional flossing. However, the dental water jet was superior to floss in fighting inflammation; reducing bleeding up to 93% better and gingivitis up to 52% better than traditional brushing and flossing.⁴⁹ Likewise, a recent study of 105 adolescents ranging in age from 11 to 17 years compared the Waterpik® dental water jet with a tip designed specifically for orthodontic appliances (**Photo 6**) plus manual toothbrushing to manual toothbrushing plus floss via floss threader and manual toothbrushing alone. The addition of the Waterpik® dental water reduced 3.76 times more plaque than flossing with a floss threader and 5.83 times more plaque than manual toothbrushing alone. The dental water jet also provided a significantly better reduction in bleeding; 84.5% from baseline. This was 26% better than the results achieved with dental floss.⁵⁰

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, in-office scheduling, 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. Table 4 highlights web based oral health and diabetes resources.

Table 4: Oral Health and Diabetes Resources

Organization	Website
American Academy of Periodontology	www.perio.org
American Dental Association	www.ada.org
American Dental Hygienists Association	www.adha.org
Ask.Advise.Refer Smoking Cessation Program	www.askadviserefer.org
American Diabetes Association	www.diabetes.org
Centers for Disease Control	www.cdc.org
National Institute for Diabetes, Digestive & Kidney Diseases	www.niddk.nih.gov



Photo 3:
Waterpik®
Pik Pocket®
Subgingival
Irrigation Tip



Photo 4:
Waterpik®
SenSonic®
Professional
Toothbrush,
Model
SR-1000W



Photo 5:
Waterpik®
Power Flosser,
Model
FLA-220



Photo 6:
Waterpik®
Orthodontic
Tip

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POST TEST COURSE #08-10

The Diabetes Epidemic: The Impact on Oral Healthcare Providers

- 20.8 million or __percentage of the population has diabetes.**
 - 3.6
 - 7.0
 - 8.7
 - 18
- Most people with diabetes have type 1; but currently, cases of type 2 are responsible for the increase in the number of people with diabetes**
 - Both statements are true
 - The first statement is true, the second statement is false
 - The first statement is false, the second statement is true
 - Both statements are false
- Type 2 diabetes is increasingly prevalent in?**
 - African Americans
 - Hispanic/Latino American
 - Native Americans
 - All of the above
- Pre-diabetes means you are suffering from impaired glucose tolerance; It is estimated to affect 54 million Americans.**
 - Both statements are true
 - The first statement is true, the second statement is false
 - The first statement is false, the second statement is true
 - Both statements are false
- Risk factors for type 2 diabetes are:**
 - Increasing age
 - Obesity
 - Lack of physical activity
 - All of the above
- People with diabetes are more likely to have heart disease; Heart disease is the leading cause of death for those with diabetes**
 - Both statements are true
 - The first statement is true, the second statement is false
 - The first statement is false, the second statement is true
 - Both statements are false
- Before providing treatment on a individual with diabetes, it is important to know:**
 - A1C test results
 - Chairside blood glucose reading
 - Blood pressure and cholesterol levels
 - All of the above
- People with poor glycemic control have more periodontal disease; but poor glycemic control has no effect on periodontal treatment outcomes.**
 - Both statements are true
 - The first statement is true, the second statement is false
 - The first statement is false, the second statement is true
 - Both statements are false
- Periodontal therapy along with systemic antibiotics has been shown to:**
 - Have no effect on glycemic control
 - Improve glycemic control for up to 3 months
 - Improve glycemic control for up to 6 months
 - Improve glycemic control for up to 12 months
- The only self care device tested on people with diabetes is:**
 - Power toothbrush
 - Power flosser
 - Dental water jet
 - Tongue cleaner
- The most common medical emergency that occurs in people with diabetes is hyperglycemia. This occurs when the blood glucose level goes above 60 mg/dl.**
 - Both statements are true
 - The first statement is true, the second statement is false
 - The first statement if false, the second statement is true
 - Both statements are false
- Signs/symptoms of hypoglycemia may include:**
 - Nervousness
 - Confusion
 - Anxiousness
 - All of the above
- 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
 - All of the above
- The onset of type 2 diabetes can be delayed; but it cannot be prevented.**
 - Both statements are true
 - The first statement is true, the second statement is false
 - The first statement is false, the second statement is true
 - Both statements are false
- Gestational diabetes is defined as the development of diabetes while pregnant. It does not resolve with delivery.**
 - Both statements are true
 - The first statement is true, the second statement is false
 - The first statement is false, the second statement is true
 - Both statements are false

OBTAINING CONTINUING EDUCATION CREDITS

Water Pik, Inc. is designated as an Approved PACE Program Provider by the Academy of General Dentistry. The formal continuing education programs of this provider are accepted by the AGD for Fellowship, Mastership, and membership maintenance credits. Approval does not imply acceptance by a state or provincial board of dentistry. The current term of approval extends from 06/01/2006 through 05/31/2010.

Credits: 3 hours

If you have questions about CE requirements in your state or province, please consult your regulatory board.

Directions:

- Fill out the Waterpik CE Registration Form and Answer Sheet.
- Answers should be logged on the answer sheet. Please make a copy of your post test and answer sheet to retain for your records.
- Answers left blank will be graded as incorrect.
- Please fill out the course evaluation portion.
- The post test may be submitted via mail to:

Carol Jahn, RDH, MS
Manager, Professional Education
and Communications
Water Pik, Inc.
1730 East Prospect Road
Fort Collins, CO 80553
Fax: 630-393-4706

Scoring:

In order to receive credit, you must answer correctly 10 questions out of 15.

Results:

Will be mailed in 8 – 10 weeks.

Questions:

Please contact Carol Jahn, RDH, MS, at email at cjahn@waterpik.com 630-393-4623



CE REGISTRATION FORM AND ANSWER SHEET

Course # 08-10

The Diabetes Epidemic:

The Impact on Oral Healthcare Providers

Name: _____

Credentials: _____

Street Address: _____

City: _____

State: _____ Zip: _____

Daytime Phone: _____

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

How did you acquire this course:
Internet DVD Tradeshow Other _____