Oral Complications of Diabetes

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- Read the enclosed course.
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Faculty

Diane Thompson, RN, MSN, CDE, CLNC, has an extensive history in nursing and nursing education. She possesses a strong background in diabetes and cardiac care, starting her professional career at the cardiac care area of the Cleveland Clinic in Cleveland, Ohio. Ms. Thompson took the knowledge and experience she learned from the Cleveland Clinic and transferred it into the home health arena in rural Ohio, after which she moved to Florida and obtained further knowledge while working as a PRN nurse in all areas, including medical/surgical, intensive care, emergency, critical care, and cardiology. With a desire to have a specific area to concentrate her profession, Ms. Thompson accepted a position as a pneumonia case manager, which led into a diabetes case manager career.

Ms. Thompson has been employed in diabetes care since 2001, when she was hired as a diabetes case manager. After the completion of 1,000 hours of education to diabetes patients, Ms. Thompson earned her certification as a diabetes educator in 2003. From 2006 to 2018, Ms. Thompson was the Director of Diabetes Healthways at Munroe Regional Medical Center in Ocala, Florida. As the director of the diabetes center, Ms. Thompson was responsible for the hospital diabetes clinicians, hospital wound care clinicians, and out-patient education program. Today, she is the nurse manager of a heart, vascular, and pulmonary ambulatory clinic at Metro Health System in Cleveland, Ohio. Ms. Thompson has also lectured at the local, state, and national level regarding diabetes and the hospital management of hyperglycemia. Ms. Thompson is a member of the ADA, AADE, Florida Nurses Association, and the National Alliance of Certified Legal Nurse Consultants.

Ms. Thompson acknowledges her family as her greatest accomplishment. She is a wife of more than 30 years and a mother of a daughter and son, of which she is very proud. Ms. Thompson credits her husband for the support needed to set a goal and achieve it. He has been by her side through nursing school and completion of her Bachelor's degree and Master's degree, which she was awarded in 2015 from Jacksonville University in Florida.

Faculty Disclosure

Contributing faculty, Diane Thompson, RN, MSN, CDE, CLNC, has disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

Division Planner

Sharon Cannon, RN, EdD, ANEF

Director of Development and Academic Affairs

Sarah Campbell

Division Planner/Director Disclosure

The division planner and director have disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

Audience

This course is designed for nurses and allied health professionals involved in the care of patients with diabetes.

A complete Works Cited list begins on page 11.

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Course Objective

Diabetes can have a significant impact on oral health, which in turn affects patients' overall health and quality of life. The purpose of this course is to provide nurses with the information necessary to identify oral complications of diabetes and educate patients with diabetes regarding the steps necessary to prevent periodontal disease.

Learning Objectives

Upon completion of this course, you should be able to:

1. Outline the prevalence of diabetes in the United States.
2. Review the physiology of the oral cavity.
3. Identify the mechanisms that influence the development of oral complications in patients with diabetes.
4. Describe the link between periodontal disease and other diabetes-related complications.
5. Discuss the options for treatment and prevention of diabetes-related oral complications.

Sections marked with this symbol include evidence-based practice recommendations. The level of evidence and/or strength of recommendation, as provided by the evidence-based source, are also included so you may determine the validity or relevance of the information. These sections may be used in conjunction with the course material for better application to your daily practice.

INTRODUCTION

Diabetes is a multifaceted disease process affecting multiple systems in the human body, including the cardiovascular, cerebrovascular, and renal systems. However, less recognized complications occur as well. One of these complications is the relationship between diabetes and periodontal disease. In a report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, periodontal disease was identified as one of the treatable pathologic conditions found in adults with diabetes [1]. Sustained hyperglycemia predisposes the tissues of the oral cavity to opportunistic infection, accumulation of plaque, periodontal disease, oral paresthesia, and alteration in taste [2]. However, this aspect of diabetes care is often neglected. If early emphasis on oral hygiene and dental visits is made for these patients, advancement to periodontal disease and the related complications of the disease can be avoided.

AN OVERVIEW OF DIABETES

EPIDEMIOLOGY

Diabetes is a progressive disease process influencing fuel metabolism by the body [3]. Carbohydrate, protein, and fat metabolism are altered when insulin, the mediator of fuel, is not available. Insulin deficiency can result from defects in insulin secretion and/or diminished tissue response to insulin. The result of this defect in insulin secretion and/or insulin resistance is hyperglycemia [4]. The chronic metabolic dysregulation associated with diabetes can result in long-standing damage to various organs, including the eyes, kidneys, nerves, heart, and blood vessels [5].

According to the Centers for Disease Control and Prevention, the prevalence of diagnosed diabetes has increased from less than 1% of the U.S. population in 1958 to more than 7% in 2015 [6]. As of 2019, 11.3% of the U.S. population, or 37.3 million Americans, have diabetes. Unfortunately, 8.5 million of these individuals are unaware of their diagnosis [7; 8]. Diabetes has been considered epidemic since the 1972, and the percentage of Americans expected to have diabetes or impaired glucose tolerance is estimated to reach 15% to 20% by the year 2030 [9; 53]. In addition, prediabetes is now estimated to affect 96 million Americans [8].

The scope of the diabetes problem is vast and diverse, particularly among geographical regions. In 2018, the prevalence of diagnosed diabetes in the United States was highest among Southern states, including West Virginia (13.4%), Mississippi (12.9%), Louisiana (12.9%), Alabama (12.7%), Arkansas (12.4%), and Kentucky (12.1%) [10]. Genetics, race, age, and lifestyle significantly influence the onset and progression of the disease process [4]. Although all races and ethnicities can develop diabetes, the prevalence is greatest among American Indian/Alaskan Natives [7; 8]. In addition, according to 2013–2016 survey data, the incidence of diagnosed and undiagnosed diabetes is estimated to be 19.8% among Hispanic individuals and 17.9% among non-Hispanic Black Americans 20 years of age and older, compared with the overall population rate of 14% [7; 8; 11]. However, American Indians/Alaskan Natives present the greatest risk for the development of type 2 diabetes; their risk is more than two times greater than that of White Americans. It is estimated that 15.1% of American Indians/Alaskan Natives older than 18 years of age have diabetes [7]. The highest prevalence of diabetes in the United States is observed in American Indians in the Southwest, where an estimated 22.2% of the population has developed diabetes [7].

The most rapid increase in diabetes prevalence in the last decade has been among adolescents. Historically, children and adolescents with hyperglycemia have been diagnosed with type 1 diabetes, an autoimmune disease that results in the body being unable to produce adequate amounts of insulin. However, in 2012, researchers from the SEARCH for Diabetes in Youth study released data showing a 21% increase in type 2 diabetes in youth 10 to 19 years of age between 2001 and 2009, with the number of cases rising faster among girls than boys [7; 12]. Furthermore, it has been predicted that

children born in this millennium will have a one in three chance of developing diabetes in their lifetime; among high-risk ethnic groups, the estimate is as high as one in two [13; 53]. By 2060, it is estimated that approximately 220,000 people younger than 20 years of age will be diagnosed with type 2 diabetes, an increase of 700% from today [55].

DIAGNOSIS AND SCREENING

The most common types of diabetes are type 1 and type 2. However, gestational diabetes is also relatively common and is a source of significant morbidity and mortality. Gestational diabetes is first recognized in pregnancy, usually around the 24th week of gestation, and typically resolves after the birth of the child [14]. Other less common types of diabetes include [9; 15]:

- Maturity-onset diabetes of the young: A genetic, autosomal-dominant defect of the pancreatic beta cells resulting in insulin deficiency and decreased insulin release without the presence of insulin resistance and obesity. This form of diabetes typically develops in patients younger than 25 years of age. It is a different clinical entity than type 2 diabetes of the adolescent, which presents with insulin resistance.
- Diabetes related to diseases of the exocrine pancreas, such as cystic fibrosis, and various endocrine diseases, such as Cushing syndrome, acromegaly, and chromocytoma
- Drug-induced diabetes resulting from the use of certain medications, particularly high-dose corticosteroids

All adults older than 45 years of age should be screened for diabetes every three years or every two years if they have any risk factors for type 2 diabetes [15; 16]. In addition, individuals of any age who are at risk for or are suspected of having diabetes should be screened. Established risk factors for type 2 diabetes include [17; 18]:

- Age older than 45 years
- Body mass index (BMI) greater than or equal to 25 kg/m^2
- Family history of type 2 diabetes
- Habitual physical inactivity
- Race/ethnicity (e.g., African American, Hispanic American, American Indian/Alaska Native, Pacific Islander)
- Impaired glucose tolerance or elevated fasting glucose
- Previous history of gestational diabetes or giving birth to a child weighing more than 9 pounds
- Hypertension (blood pressure greater than 140/90 mm Hg in adults)
- Abnormal lipid levels (high-density lipoprotein [HDL] level <35 mg/dL and/or triglyceride level >250 mg/dL)
- Polycystic ovarian syndrome
- History of vascular disease
- Acanthosis nigricans (most common among individuals of African descent)

DIAGNOSTIC CRITERIA

The diagnostic criteria for type 2 diabetes are fairly straightforward and are based on fasting plasma glucose and postprandial plasma glucose levels (***Table 1***). After a diagnosis of type 2 diabetes has been definitively made, education on self-care management is necessary in order to obtain euglycemia and prevent complications related to the detrimental effects of hyperglycemia [14]. The majority of patients with type 2 diabetes will require oral medications to achieve adequate glucose control within five years of diagnosis [19]. When glucose levels cannot be adequately controlled with oral medications, the use of injectable medications is necessary. If elevated blood glucose levels are untreated and continue to rise, the result can be hyperosmolar hyperglycemia syndrome and ultimately death [20].

DIAGNOSTIC CRITERIA FOR TYPE 2 DIABETES			
Stage	**Fasting Plasma Glucose Level**	**Two-Hour Postprandial Plasma Glucose Level**	**Glycated Hemoglobin (HbA1c)**
Euglycemia	<100 mg/dL	<140 mg/dL	<5.7%
Prediabetes	>100 mg/dL but <126 mg/dL	>140 mg/dL but <200 mg/dL	5.7% to 6.4%
Diabetes[a]	≥126 mg/dL	≥200 mg/dL	≥6.5%
[a]A random blood glucose level ≥200 mg/dL with symptoms of hyperglycemia is also indicative of diabetes.			
Source: [15; 21]			*Table 1*

AN OVERVIEW OF THE PHYSIOLOGY OF THE ORAL CAVITY

The mouth is the first segment of the digestive system and a secondary opening of the airway in the respiratory system. The oral cavity includes various structures, such as the teeth, gingivae, palate, lips, tongue, cheek mucosa, and the salivary glands. Each of these components serve a specific purpose, and poor oral health can affect patients' overall health and quality of life.

The adult mouth typically contains 32 permanent teeth, and the primary role of teeth in humans is mastication, although they also affect speech, facial structure/appearance, and social acceptance. Each tooth consists of enamel, dentin, and dental pulp (i.e., the "nerve"). Enamel is the external layer of the tooth and is composed mainly of hydroxylapatite, a crystallized form of calcium phosphate. It is the hardest and most mineralized substance in the body, even more so than bones. Dentin is the substance that underlies the enamel of the tooth. The significantly lower mineral content makes dentin softer than enamel and permits a more rapid progression of decay. Commonly called the "nerve" of the tooth, the dental pulp is a complex configuration of soft connective tissue consisting of blood vessels, nerve fibers, fibroblasts, macrophages, lymph vessels, lymph cells, and T-lymphocytes. The teeth are anchored in place by the periodontal ligament and its attachment to the supporting alveolar bone. The gingiva, or gums, is a thick, fibrous tissue covered with a mucous membrane with a keratinized surface [22]. The gingiva serves various purposes in the oral cavity depending on its location and tissue type.

One of the major functions of the oral cavity is the production of saliva, which is excreted from the [23]:

- Submaxillary (or submandibular) glands
- Sublingual glands
- Parotid glands
- Serous acinar cells
- Mucous acinar cells

Saliva serves many purposes. It facilitates speech and lubricates food for swallowing [23]. Salivary amylase digests starch into oligosaccharide molecules, which is similar to the action of pancreatic α-amylase that digests starch in the small intestines.

As a person ages, the soft tissue of the oral cavity begins to experience atrophy and the epithelium thins, particularly in the cheek and tongue. This results in an 80% loss in taste buds among the oldest old (older than 85 years of age). Decreasing salivary output in older persons results in further impairments to the taste sensation. Atrophic tissues are prone to tissue ulceration, placing the aging person at a greater risk of infection. Additionally, receding gingivae and erosion of the gum line are risks for oral infection. Natural tooth loss of aging can be exacerbated by years of inadequate dental care/oral hygiene, tooth decay, tobacco use, and hyperglycemia [23].

PATHOPHYSIOLOGY OF DIABETES-RELATED ORAL COMPLICATIONS

Periodontal disease is unequivocally a major complication of diabetes, and poorly controlled diabetes and periodontal disease are closely linked [1; 24; 25]. Susceptibility to periodontitis is increased by approximately threefold in people with diabetes. [25]. Individuals with diabetes frequently complain of oral changes, including diminished salivary flow and/or xerostomia, altered saliva composition, inflammation, loss of sensation, changes in taste perception, numbness, burning mouth syndrome, and lesions of the oral mucosa and tongue [26]. Although these are not all symptoms of periodontitis, the oral changes can predispose an individual for the development of gingivitis and periodontitis. There is evidence of a relationship between periodontal disease severity and diabetes (particularly poorly controlled diabetes), but the exact mechanism by which one might influence the other has not been definitively determined [25]. Emerging evidence also suggests the existence of a two-way relationship between diabetes and periodontitis, with diabetes increasing the risk for periodontitis and periodontal inflammation negatively affecting glycemic control [25]. Many believe that the host of oral changes evidenced in patients with diabetes may act synergistically to predispose these individuals for periodontitis [27].

Both diabetes and periodontal disease share a common pathogenesis that involves enhanced inflammatory response at the local and systemic levels. This inflammatory response is mainly caused by the chronic effects of hyperglycemia and specifically the formation of biologically active glycated proteins and lipids [25; 28]. Patients with diabetes, especially uncontrolled diabetes, are at an increased risk for impaired healing, and the periodontal pocket can experience persistent inflammation and bacterial infection in patients with periodontal disease, which can be made worse by this impaired healing [4; 27]. Loss of teeth because of aggressive periodontitis may also occur [4].

The pathophysiology of endothelial dysfunction and inflammation is the root cause of much of the microvascular and macrovascular deterioration associated with diabetes [4; 25]. The normal metabolic response to a glucose load is an increase in free fatty acids and insulin. These changes result in a transient decrease in endothelium-derived nitric oxide production and in endothelium-mediated vasoconstriction. In the presence of normal glucose tolerance, endothelial nitric oxide production and vasodilation return to normal within two hours. However, in patients with diabetes, endothelium-mediated vasoconstriction continues for hours [29]. This impaired blood flow can affect collagen synthesis, maturation, and homeostatic turnover, all of which can result in impaired healing and the development of periodontal disease [27].

In addition to vasoconstriction, endothelial dysfunction is correlated with aggregation of platelets, a proinflammatory state characterized by the accumulation of leukocytes and coagulation products on the endothelium. Fibrinolysis is decreased, and thrombosis is increased. As the secretion of prostacyclin and nitric oxide induce vasoconstriction, plasma cytokine and prothrombin factors levels increase. This makes the plasma markedly procoagulant and antifibrinolytic, promoting atherosclerosis [4]. The Insulin Resistance Atherosclerosis Study also demonstrated that chronic hyperglycemia was positively associated with increased intimal-medial wall thickness [28]. These changes in both the microvascular and macrovascular systems lead to reduced vascular reactivity and increased production of glycation end products [29]. The accumulation of advanced glycation end products in the gingival tissues is generally responsible for the oral complications of diabetes. In fact, individuals with poorly controlled diabetes have a two- to three-fold increase in the prevalence of oral lesions and periodontal disease.

Necrotizing ulcerative gingivitis can occur but is a relatively rare and severe form of periodontal disease marked by the destruction of gingival tissue and ulcerations of the epithelium of the mouth [30]. Diabetes has been implicated in the development of this condition.

Xerostomia, or dryness of the mouth (usually associated with salivary gland hypoperfusion), is a common complaint among individuals with type 2 diabetes [31; 32]. Xerostomia can lead to markedly increased dental caries, parotid gland enlargement, inflammation, cheilitis, ulceration of the tongue and buccal mucosa, oral candidiasis, sialadenitis, and halitosis. In individuals with xerostomia, the development of dental caries can be severe, resulting in infection of the dental pulp and tooth abscess [28]. This may occur in addition to periodontal disease and can affect a patient's ability to maintain adequate oral hygiene.

Changes in oral flora and salivary pH have also been noted in patients with diabetes [32; 33]. The role of these changes is unknown, but the increase in pH (making an acidic oral environment) is believed to have a detrimental effect on the teeth and gingiva.

PERIODONTAL DISEASE AND OTHER DIABETES COMPLICATIONS

CARDIOVASCULAR DISEASE

Oral disease has implications in other chronic complications related to diabetes [34]. Not only is the risk of periodontitis greater in individuals with diabetes, evidence suggests that there may be a relationship between chronic periodontitis and cardiovascular disease and that periodontitis may be a risk factor for cardiovascular disease [35; 36; 37; 38; 39; 40]. Research has shown that treating severe periodontal diseases is associated with improved blood flow, greater arterial elasticity, enhanced endothelial function, and improvement in levels of systemic inflammatory markers (e.g., C-reactive protein, interleukin-6) [35; 41]. The American Heart Association has stated that it is reasonable to hypothesize that periodontal disease contributes to the advancement of type 2 diabetes [42]. Dental infection has also been associated with coronary atherosclerosis, and bacterial DNA from periodontal infections has been identified in atherosclerotic plaques [28]. As a result of this relationship, periodontal disease is a predictor of death among individuals with diabetes and associated ischemic heart disease [43].

NEPHROPATHY

As with cardiovascular disease, the proposed mechanism for the effect of periodontitis on the development of kidney disease is systemic inflammation [44]. The death rates from nephropathy are higher in individuals with diabetes and severe periodontal disease than those with no or mild periodontal disease [43; 45]. Additionally, the risk of mortality from combined diabetic nephropathy and ischemic heart disease is three times higher in patients with diabetes and severe periodontitis than in those without periodontitis [25].

NEUROPATHY

It is widely assumed that diabetes-related neuropathy and microcirculatory disturbances lead to alterations in the oral cavity. Diabetes-related peripheral neuropathy can cause oral pain, hyperesthesia, dysesthesia, and loss of sensation, whereas autonomic neuropathy may impair salivary flow rate [46]. Peripheral and autonomic neuropathies are independent risk factors for tooth loss, temporomandibular disorders, and alteration of oral sensation in individuals with type 2 diabetes [26; 46].

RETINOPATHY

Severe periodontal disease is associated with elevated blood lipopolysaccharide levels as a result of periodontogenic bacteria, which induce higher levels of interleukin-6 and tumor necrosis factor-α. The presence of proinflammatory cytokines such as interleukins-6 is implicated in the pathogenesis of diabetic retinopathy, which is characterized by abnormalities of the retinal blood vessels [47; 48; 49]. Severity of periodontal disease is correlated with the severity of diabetic retinopathy. In one study, levels of interleukin-6 in the vitreous fluid were predictive of periodontal disease severity [47]. Improvements in diabetes and blood pressure treatments and advances in laser surgery and intraocular drug delivery have helped to decrease the risk of vision loss from diabetic retinopathy. Nevertheless, it continues to be a leading cause of new-onset blindness in working-age individuals in the United States, despite established screening programs, early diagnosis, and treatment [49; 50; 51].

TREATMENT AND PREVENTION

Depending on the severity of the disease, there are several options for the treatment of periodontitis. If oral disease is suspected in the patient with diabetes, referral to a periodontist is the first step. First-line approaches to the treatment of periodontitis include scaling, root planing, and locally administered antibiotics. Localized therapy with controlled-release antimicrobials has been shown to diminish levels of C-reactive protein and additional inflammatory markers [44]. Dosages will be dependent on the manifestation and extent of the infection and the delivery method chosen (e.g., pastilles, lozenges, troches, implanted cords or chips) [28]. With more advanced disease, dental surgery may also be necessary.

EVIDENCE-BASED PRACTICE RECOMMENDATION

The National Institute for Health and Care Excellence recommends that healthcare professionals advise adults with type 2 diabetes at their annual review that they are at higher risk of periodontitis and, if they get periodontitis, managing it can improve their blood glucose control and can reduce their risk of hyperglycemia.

(https://www.nice.org.uk/guidance/ng28. Last accessed March 20, 2023.)

Level of Evidence: Expert Opinion/Consensus Statement

Treatment of symptoms and of other oral health issues to improve comfort is also indicated. For patients with xerostomia, palliative interventions include over-the-counter saliva substitutes or prescription muscarinic agonists (e.g., pilocarpine, cevimeline) [28]. Patients should be instructed to complete the full oral medication regimen to prevent relapse or the development of drug resistance [4].

Prevention of periodontal disease is the best option, particularly considering the increased risks in patients with diabetes. Education regarding the causes of periodontal disease and how it is related to diabetes-associated macrovascular and microvascular diseases is necessary. For patients with diabetes who have or are at risk for periodontal disease, healthcare providers should [28]:

- Ask about the patient's general oral health and if he or she has noticed any signs of oral infection, halitosis, or poor taste sensations.
- Inquire regarding the individual's last dental examination and whether he or she has ever been treated for periodontitis.
- Encourage the individual to maintain regular dental visits (at least every six months).
- Encourage immediate consultation with a dental professional if there are any signs or symptoms of infection, such as sore, swollen, or bleeding gums; loose teeth; mouth ulcerations; or pain.
- Perform basic oral examinations regularly.
- Refer to a dental provider if a relationship has not previously been established.
- Stress the importance of good oral hygiene practices, including appropriate brushing and flossing.

If a patient has been treated for periodontal disease in the past, encourage him or her to continue treatment, with close follow-up and disease monitoring.

Individuals with diabetes are compliant with oral health care regimens when informed and positively reinforced [2]. However, individuals with diabetes are significantly less likely than those without diabetes to have seen a dental health provider within the past year, and the primary reason given for not seeing a dental provider is lack of perceived need [1].

Because those who believe they are highly susceptible to dental disease make more preventative dental visits, patients with diabetes should be counseled to take their oral health seriously and to take steps to prevent diabetes-related periodontal disease early [2].

Regular dental examinations should be a platform for prevention, early detection, and treatment of periodontal disease. In addition to protecting oral health, regular dental cleanings may improve glycemic control in patients with uncontrolled diabetes [34].

CASE STUDY

Patient A is a woman, 69 years of age with a 25-year history of type 2 diabetes. She presents to the education department for information regarding diabetes self-management. She has not received any education previously and has had a difficult time controlling her glucose levels over the past 18 months. According to her primary care provider, Patient A's glycated hemoglobin (HbA1c) level has not been less than 8.5% for the past 12 months. She is currently performing self-monitoring of blood glucose three times per week.

Patient A's past medical history is positive for diabetes, hypertension, and a 52-year history of tobacco use. She is 5 feet 4 inches in height and currently weighs 225 pounds; her calculated BMI is 38.6 kg/m^2, qualifying her as obese. Within the last two months, the patient visited an ophthalmologist, who has diagnosed her with cataracts and moderate non-proliferative retinopathy.

At her education appointment, Patient A complains of numbness in her feet and tingling in her mouth and jawline. When asked about her last dental visit, the patient states she does not go to the dentist because they always find something wrong and she hates the sound of the drill. When questioned about her daily oral hygiene routine, Patient A states she usually brushes her teeth in the morning but has begun to experience pain and notices blood in her saliva afterwards. She denies flossing because it is painful and she feels it is "messy." She does state that her daughter has encouraged her to brush her teeth more often because she has noticed increasingly bad breath over the past six months.

The certified diabetes educator asks to examine the patient's gums and oral cavity, but she states she would prefer not to because her teeth "aren't as nice as they once were." The diabetes educator explains the importance of good oral hygiene and the effect that diabetes can have on oral health. With some persuasion, Patient A permits the nurse to examine her mouth. The assessment reveals signs of gingivitis, a dry, cracked tongue, and two visible abscesses, one on the upper left gum and another on the lower left gum near the first molar. The presence of halitosis is noted.

The diabetes educator provides Patient A with information regarding the relationship between periodontal disease and other diabetes complications. Further instructions are given on the need for treatment to prevent or limit progressive damage. Patient A agrees to schedule an appointment with her dentist and promises to maintain her appointment.

Two weeks later, Patient A sees her dentist. Dr. T performs a complete oral examination, including x-rays. The patient is diagnosed with xerostomia, extensive dental caries with root involvement, and infected abscesses. The x-rays reveal dental caries with active infection of the central and lateral left upper and lower incisors progressing to the root. A probing depth of 4–5 mm is noted upon assessment of the gingiva, indicating probable periodontal disease. Abscesses are noted at the base of the upper central and lateral incisors. Patient A is scheduled for extraction of the affected teeth and antibiotic therapy to control the infectious process. She is encouraged to brush her teeth at least twice a day, floss daily, use an over-the-counter saliva replacement to improve oral moisture, stop smoking immediately, and follow-up in two weeks. Referral to a periodontist is also made.

Two weeks later, Patient A returns to see her dentist. Although her abscesses are clearing, they are not completely healed and antibiotic therapy is continued for an additional week. The patient reports attempts to stop smoking but is experiencing difficulties. Her halitosis is also improving. An appointment with the periodontist has been scheduled for the following week.

Patient A also follows up with the diabetes educator. Her blood glucose levels appear to be coming back to a normal level, although the evidence has not been seen in her HbA1c as of yet. Intensive education regarding the need to maintain her standards of care is provided, including self-blood glucose monitoring, weight management, dilated retinal eye examination, comprehensive foot examination, medical nutrition therapy, physical activity, immunizations, and dental care and follow-up. The nurse reiterates the relationship between diabetes and poor dental health, and Patient A states that she was never informed about the relationship by any of her healthcare providers or family members. Finally, the patient is enrolled in a smoking cessation class to support her efforts to quit smoking.

After three weeks, Patient A is informed by Dr. T that her general oral health is clear and she is free from oral abscesses, and a plan of care to address her periodontal disease has been established. Her oral mucosa moisture is increased, and her halitosis is resolved. She schedules another dental hygiene appointment for six months in the future. Although she has not yet quit smoking, she states that she has significantly decreased the number of cigarettes she smokes every week.

CONCLUSION

The maintenance of healthy dentition is important for the purposes of aesthetics, dietary intake and nutrition, quality of life, and overall general health condition [28]. Healthcare professionals play an increasingly integral part in ensuring optimal oral health in their patients, particularly those for whom access to dental care is difficult. However, studies indicate that knowledge of oral health issues remains suboptimal in this population [52; 54]. Working together as part of the interdisciplinary team, healthcare and dental care professionals can improve the oral health of patients with diabetes and, by extension, their overall health and quality of life.

Implicit Bias in Health Care

The role of implicit biases on healthcare outcomes has become a concern, as there is some evidence that implicit biases contribute to health disparities, professionals' attitudes toward and interactions with patients, quality of care, diagnoses, and treatment decisions. This may produce differences in help-seeking, diagnoses, and ultimately treatments and interventions. Implicit biases may also unwittingly produce professional behaviors, attitudes, and interactions that reduce patients' trust and comfort with their provider, leading to earlier termination of visits and/or reduced adherence and follow-up. Disadvantaged groups are marginalized in the healthcare system and vulnerable on multiple levels; health professionals' implicit biases can further exacerbate these existing disadvantages.

Interventions or strategies designed to reduce implicit bias may be categorized as change-based or control-based. Change-based interventions focus on reducing or changing cognitive associations underlying implicit biases. These interventions might include challenging stereotypes. Conversely, control-based interventions involve reducing the effects of the implicit bias on the individual's behaviors. These strategies include increasing awareness of biased thoughts and responses. The two types of interventions are not mutually exclusive and may be used synergistically.

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