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Oral Health and Type 2 Diabetes

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Abstract

Type 2 diabetes mellitus (T2DM) has been described as a new epidemic. Approximately 285 million people worldwide suffer from diabetes, and this number is predicted to increase by about 50% by year 2030. This article will review oral health manifestations of diabetes, and discuss associations between periodontal disease and diabetes. Although there is a strong body of evidence that supports the relationship between oral health and T2DM, oral health awareness is lacking among patients with diabetes and other health professionals. There is a need for the treating physician to be educated about the various oral manifestations of diabetes so that they can be diagnosed early and timely referrals to oral health specialists can be made. The established link between periodontitis and diabetes calls for an increased need to study ways to control both diseases, particularly among populations with health disparities and limited access to oral and health care.

Keywords

Periodontal health; diabetes; periodontal therapy

Hyperglycemia in diabetes has been shown to be an important risk factor for the manifestation of vascular complications. The five classic complications associated with DM include retinopathy, neuropathy, nephropathy, cardiovascular complications (coronary arterial disease, stroke and peripheral vascular disease) and delayed wound healing. Periodontal disease has recently been recognized as the “sixth complication” of DM⁽¹⁾.

Diabetes is a common disorder with concomitant oral manifestation that impacts dental care and there is concern about the ability of oral manifestations to profoundly affect metabolic control of the diabetes state. Physicians working to optimize the metabolic control of these patients should recognize the impact of controlling the progression of these oral complications. This warrants a comprehensive plan that involves close collaboration between physicians and oral health care providers, which will hopefully lead to better

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glycemic control among this patient population, and also lower the impact of personal and societal burden, of these potentially disabling comorbid conditions. Oral complications of diabetes can be devastating for the patient. These may include, but are not limited to candidiasis, dental caries, tooth loss, gingivitis, lichen planus, neurosensory disorders (burning mouth syndrome), periodontitis, salivary dysfunction and xerostomia, and taste impairment,

ORAL IMMUNOLOGIC AND INFECTIOUS DISEASES

Periodontal Disease

Chronic periodontal disease results in progressive destruction of the supporting tissues of the teeth as well as pocket formation, recession or both, which may lead to tooth loss because of extensive destruction of alveolar bone. It is well documented that periodontal disease is considered to be one of the main reasons for tooth loss among individuals with diabetes⁽²⁻⁵⁾. A meta-analysis of four studies with a total of 3,524 adults (>18 years old) showed those with diabetes have a two-fold higher risk of developing periodontal disease compared to those without diabetes⁽⁶⁾. Additionally, there are considerable racial disparities regarding the rates of periodontal disease within patients with diabetes and periodontal disease. National prevalence estimates of periodontal disease for African Americans with T2DM have been reported at 59.7%⁽⁷⁾; whereas, Fernandes *et al.*⁽⁸⁾ reported significantly higher rates for African Americans of Gullah ancestry with T2DM (70.6%).

Several mechanisms have been proposed to explain the increased susceptibility to periodontal diseases among patients with uncontrolled DM, including alterations in host response, collagen metabolism and vascularity. Individuals with poorly controlled T2DM present an exaggerated inflammatory response to the bacterial challenge of periodontitis. A hyperinflammatory response coupled with impaired wound healing and repair may enhance the inflammatory reaction and periodontal tissue destruction for these patients^(9, 10). Several controlled clinical trials have confirmed that subjects diagnosed with diabetes have a greater prevalence of periodontal diseases compared to healthy individuals^(8, 11, 12). In addition, severe periodontitis may increase the risk of poor glycemic control^(13, 14). The host inflammatory response appears to be the critical determinant for susceptibility to and severity of periodontitis in systemically compromised individuals^(15, 16), such as patients with T2DM. There is also evidence suggesting that periodontitis-induced bacteremia will cause elevations in serum proinflammatory cytokines, and reactive oxygen species leading to etiopathogenesis of metabolic syndrome and increased insulin resistance.

The chronic inflammatory state induced by untreated periodontitis may contribute to insulin resistance, worsening glycemic control⁽¹⁷⁾. A recent report by Bandyopadhyay *et al.*⁽¹⁸⁾, using a study population of Gullah African Americans with T2DM and no recent clinical history of periodontal therapy, concluded that there are significant associations between periodontal disease progression and diabetes control status. Untreated periodontitis poses an inflammatory challenge to the patient, and the reduction of periodontal inflammation has potential positive benefits to the patient both locally and systemically⁽¹⁹⁾. Grossi *et al.*⁽²⁰⁾ reported that adults with DM who received ultrasonic scaling and curettage in combination with systemically administered doxycycline therapy demonstrated, at three months, significant reductions in mean HbA1c, reaching nearly 10% from the pre-treatment values. Systematic review studies have also concluded that non-surgical periodontal therapy with or without antibiotics led to a mean reduction in the HbA1c of 0.4% after 3 to 4 months relative to no treatment^(21, 22). Diabetes related microvascular complications are estimated to reduce by 35% for every 1% point decrease in HbA1c levels; further, 1% absolute decrease in HbA1c level may decrease the risk of any diabetes related death by 21%⁽²³⁾.

Dental Caries

Dental caries are common chronic disease conditions that cause pain and disability across all age groups. If left untreated, dental caries can lead to pain, infection, tooth loss, and, eventually, edentulism. The presence of these oral manifestations can hinder quality of life, nutrition, and, potentially, glycemic control. It is important to know that patients with DM are susceptible to other oral conditions, such as periodontal and salivary disorders (dry mouth), which could increase their risk of developing new and recurrent dental caries. A review of the literature indicates that there is no clear association between DM and dental caries, but several studies have reported a greater history of dental caries in people with DM^(24, 25). Decreased salivary secretion, increase of carbohydrate in the parotid gland saliva, growth of oral yeasts, increased counts of *Mutans streptococci* and *Lactobacilli* are some of the factors implicated to be responsible to predispose diabetics to higher incidence of dental caries⁽²⁶⁾.

Oral Mucosal Diseases

Diabetes is also associated with the development of certain oral soft tissue lesions, although these associations are not consistently reported across different diabetic populations⁽²⁷⁾. There are reports of greater prevalence of fissured tongue, irritation fibroma, traumatic ulcers⁽²⁷⁾, lichen planus⁽²⁸⁾, recurrent aphthous stomatitis⁽²⁹⁾, as well as oral fungal infections, such as oral candidiasis⁽³⁰⁾. These associations may be due to chronic immunosuppression, delayed healing and/or salivary hypofunction⁽³¹⁾. They additionally represent an opportunity to coordinate diabetes care between physicians and oral health care providers.

SALIVARY DYSFUNCTION

Salivary function is essential for the maintenance of oral and systemic health^(32, 33). It is important for digestion, mastication, taste, speech, deglutition, and preservation and protection of mineralized and mucosal tissues⁽³²⁾. Xerostomia is a subjective sensation of oral dryness, so a systematic approach should be employed to determine the etiology of this condition, with distinction made between subjective complaints alone and those with measurable salivary gland dysfunction. Xerostomic complaints may be due to thirst (a common manifestation of DM), oral sensory dysfunctions, dehydration, decreased salivary flow (hyposalivation), and/or altered saliva composition. Chavez *et al.*⁽³⁴⁾ found trends toward decreased salivary flow rates as HbA_{1c} values increased, while other studies have reported that the use of one or more xerostomic medications resulted in significantly lower flow rates^(33, 35). While many medications and treatment modalities list xerostomia as a possible side effect, very few have been tested for objective changes in salivary flow⁽³⁶⁾.

Management of xerostomia should be directed to relief of symptoms, control of oral diseases and improvement of salivary function. If xerostomia is a side effect of medication use, the possibilities of modifying drug scheduling, dose adjustment, or changing medications should be explored, while some relief may also be achieved by chewing/consumption of sugar free gum/candy. Patients should be advised to avoid dry/bulky foods, spicy or acidic foods, alcoholic and carbonated beverages, and tobacco use, while a high fluid intake diet should be encouraged. The use of mouthwashes that are specific to the treatment of dry mouth and alcohol free may also alleviate the oral discomfort of xerostomia. Therapy with immunologically active saliva substitutes has demonstrated to be helpful for reducing bacterial plaque, gingivitis and positive oral yeast counts⁽³⁷⁾. Patients with xerostomic complaints should be referred to a dentist for a strict maintenance of their oral health. As xerostomia has a significant effect on a person's quality of life, all health care workers should be sensitive to those complaining of dry mouth and treat or refer them accordingly.

NEUROPATHY CONSEQUENCIES IN THE ORAL CAVITY

A common complaint among DM patients is burning mouth syndrome, an orofacial neurosensory disorder of unknown cause, characterized by a bilateral burning sensation of the oral mucosa usually in the absence of clinical and laboratory findings⁽³⁸⁾. Management of burning mouth syndrome should have an interprofessional approach to improve patient's well being and quality of life. The treatment protocol for xerostomia is frequently used for the treatment of burning mouth syndrome, allowing for the palliative care of the symptoms.

Taste detection is determined hereditarily, but it can be influenced also by occurrence of neuropathy⁽³⁹⁾. This sensory dysfunction can inhibit the ability to maintain a proper diet and can lead to poor glycemic control. Taste impairment has also been associated with the development of obesity⁽³⁹⁾, and it has been reported during the course of diabetes⁽⁴⁰⁾. The use of oral hygiene devices may be impaired by peripheral neuropathies and by diabetic retinopathy, which may impair daily oral hygiene. The use of an electric toothbrush as well as other alternative hygiene methods and a strict dental maintenance schedule are important in the long-term oral health of these patients.

CONCLUSIONS

Several studies⁽⁴¹⁻⁴⁵⁾ have indicated deficiencies in general oral health awareness among patients with diabetes. Additionally, most of these studies^(41, 42, 44) showed that a very low number of patients diagnosed with diabetes visit the dentist regularly for periodontal checkups, and many patients were unaware of the effect of diabetes on oral health. Allen *et al.*⁽⁴³⁾ reported that awareness of periodontal diseases among diabetes patients is very low compared to their reported knowledge of increased risks for heart disease, eye disease, kidney disease, and circulatory problems.

Periodontal diseases and diabetes mellitus are closely associated and are highly prevalent chronic conditions. Inflammation is a critical player in the association, and its importance is just now coming to light. Diabetes clearly increases the risk of periodontal diseases as demonstrated by several plausible mechanisms. Less clear is the impact of periodontal disease on glycemic control and the mechanisms through which this occurs. Evidence-based care emphasizes the importance of clinically relevant preventive and therapeutic measures for the management of DM and periodontal diseases. The involvement of oral health care professionals in strategies to identify individuals at risk for diabetes will extend preventive and screening efforts necessary to slow the development of these diseases and, notably, provide a portal for individuals who do not see a physician on a regular basis to enter into the general health care system.

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