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RESEARCH ARTICLE

ORAL HEALTH OF DIABETIC PATIENTS

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ABSTRACT

According to the American Dental Association (ADA), diabetes can increase the risk of oral diseases and other symptoms in the oral cavity. About one-fifth of tooth loss can be attributed to diabetes. Periodontal diseases include gingivitis and periodontitis. Gingivitis is the acute or chronic inflammation of the gums, which is usually caused by dental plaques. Five major impacts on oral health by diabetes include gum disease, dry mouth or change in taste, infection, slow healing and periodontal disease. In addition, beside affecting blood sugar; periodontal disease is also closely related to cardiovascular disease. Omega-3 polyunsaturated fatty acids (PUFA) are not only beneficial to cardiovascular and metabolism, but also can inhibit inflammation and diabetic patients.

KEYWORDS: Periodontal diseases; periodontitis; gingivitis; diabetes; oral health care.

INTRODUCTION

The International Diabetes Federation (IDF) believes that periodontal disease is one of the important complications of diabetes, as the current evidence from studies has confirmed that the diabetics are three times more likely to develop periodontal disease than non-diabetics [1-3]. Since the diabetics have poor control on blood sugar level, it is 11 times more to have faster and more severe destruction of periodontal alveolar bones [4,5]. Therefore, oral health care for diabetic patients is an important public health issue. Periodontal tissues refer to the supporting structure around the teeth and include gums, ligaments, cementum and alveolar bones, all of which will support and assist in the function of mastication. Severe periodontal disease will show an increase of blood sugar level in the body and frequent oral infection, leading the patient to have an increased resistance to insulin [6-9]. Also, periodontitis is associated with massive albuminuria, end-stage renal disease, atherosclerosis, and increased risk of heart-renal death. This in turn will put the diabetic patients in a vicious cycle of oral problems [10].

COMMON ORAL DISEASES IN DIABETICS

In view of the aging population in Taiwan, the number of diabetic patients is bound to increase, and it will place an increasing burden and impact on the future medical care. The prevalence rate of periodontitis in Taiwan is around 29.7% to 43.1%, including approximately 25-36% of mild to moderate cases and approximately 5-7% of severe cases. The prevalence of diabetes and periodontal disease in Taiwan is within the average of all other countries in the world. Diabetes, however, will promote the formation and progression of periodontitis, beside the increased blood sugar level and other diabetic complications [11-14]. The treatment must also include educating the patients to focus on controlling the blood sugar level and oral hygiene [1,15]. In recent years, studies on type 2 diabetes have found that chronic systemic inflammation may be one of the keys to insulin resistance [15]. When cytokines circulate through the body, they trigger low-grade inflammation in tissues [16-18]. They also turn the cells to resist insulin, especially in muscles and fats, further impairing the functions of internal organs, such as muscles, pancreas and liver. Once the liver is affected, it will start to

accumulate fats and aggravate the condition of insulin resistance [19]. Sometimes, it may even lead to fatty liver. The chronic inflammation throughout the body will increase not only the risk of developing type 2 diabetes but also other problems like periodontal disease, chronic kidney diseases, autoimmune diseases, etc. Usually, eating foods that help to fight against inflammation can reduce the impedance effect of insulin due to systemic inflammation [17,18]. Oral diseases in diabetics include gingivitis, periodontal disease, tooth decay, dry mouth, angular cheilitis, burning sensation in the mouth or tongue, and mold or lichen planus infection in the oral mucosa [20,21]. These diseases will also bring about the post-burning mouth syndrome, where the patient may experience dry mouth and disturbance to their olfactory sensation and taste, in which these senses can be further sensitized to feel like burning in the mouth due to reduced saliva production and pain from periodontitis and tooth decay [22,23]. Diabetes will delay healing and disrupt nerves in mucosa to bring abnormal sensation, beside the pain of gingival and tooth decay. Therefore, diabetic patients' frequent and common complaint is the dysfunction of taste. Furthermore, beside the fungal and bacterial infection, these patients may also develop lichen planus-like lesions and angular cheilitis [24,25].

COMMON SYMPTOMS OF ORAL DISEASES IN DIABETIC PATIENTS

The American Heart Association has issued the statement that nutraceuticals such as Omega-3 fatty acids can reduce the risk of cardiovascular diseases, but new studies have shown that such supplement will not help in reducing the mortality rate in type 2 diabetes or pre-diabetes patients [26,27]. In fact, they have also proven that it did not reduce the risk of ischemic heart disease or stroke. Although Omega-3 fatty acids are not involved in the metabolism of carbohydrates and proteins, the abnormal metabolism of these compounds in diabetics will decrease the activities of lipolytic enzymes for fatty acids and thus increase the level of triglycerides [12,28]. Omega-3 fatty acids can therefore reduce triglycerides when the blood sugar level is not well controlled. In diabetics, the saliva secretion is reduced and thus, restricting the ability to clean the oral cavity, where bacteria can multiply and cause dental caries, gingivitis, periodontal disease and other problems [29]. Among them, periodontal disease is the most common oral complication of diabetic patients, which will destroy the periodontal tissues, resulting in swollen gums, easy bleeding, enlarged interdental spaces, and alveolar bone atrophy [30]. Patients will experience sore sensation when drinking cold or hot beverage. They will bleed when brushing teeth or the teeth may feel a bit loosened when chewing on hard foods. Also, they have bad breath and may even have pus in the oral cavity. Tooth will decay and shows discoloration, as well as seeing roughness and discoloration in the oral mucosa [31]. These symptoms should prompt the individual to seek dental help. Compared with healthy people, periodontal disease in diabetic patients is more severe, possibly due to high level of HbA1C. Diabetic patients have poor white blood cell function, and the accumulation of glycation end-products in the body will stimulate inflammatory cells to produce cytokines and cause body-wide inflammation, all of which will increase dental plaques and destroy soft tissues around the teeth, leaving them exposed to infection and necrosis of the gums and alveolar bones[32-34].

MAINTAINING GOOD ORAL HEALTH IN DIABETICS

For diabetics, it is necessary to control their blood sugar and practice correct and effective tooth brushing technique (especially around the teeth and the gums, right after eating acidic foods). Those without a tooth can see the dentist once every year, but the diabetic patients will need to pay regular visit to dental office and maintain oral hygiene, while actively controlling their blood sugar level, in order to effectively prevent oral diseases and enjoy good oral health to have a good quality of life [35]. However, the patient should always be alerted to periodontal problems and increase the visit to dental office if possible. Patients who are completely toothless can see a dentist once every 6 months and for diabetic patients, who are not only actively controlling the blood sugar and maintain their oral hygiene, they are also recommended to schedule regular examination to effectively prevent oral diseases.

OMEGA-3 PUFA AND ORAL HYGIENE

Omega-3 fatty acids can increase oxidation of other fatty acids in the liver, adipose tissues and skeletal muscles; thereby, limiting fat accumulation. Omega-3 PUFA also reduces the production and release of adipokines that promote inflammation. In skeletal muscles, it even promotes protein synthesis to improve the overall endocrine and metabolism in diabetic patients. The recommended interval of regular dental checkup is every 3 months. Omega-3 from fish oil is polyunsaturated fatty acids, containing Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA). The compound cannot be synthesized in human body, even though our body does

require three types of Omega-3 fatty acids, namely α-linolenic acid (ALA), Docosahexaenoic acid (DHA) and Eicosapentaenoic acid (EPA). Literatures have shown that Omega-3 fatty acids did not prevent or treat diabetes or heart diseases, but they could improve insulin resistance and triglycerides in the body [36,37]. Given that obesity is known to lead to insulin resistance and metabolic syndrome, animal experiments have confirmed that long-chain Omega-3 polyunsaturated fatty acids (n-3 PUFA) are helpful in promoting insulin sensitivity, as well as inhibiting the nuclear transcription factor, kappa B (NFκB), which is known for its role in gene expression of cytokines. Studies have also pointed out that Omega-3 polyunsaturated fatty acids are not helpful in improving renal endothelial cell function and hypertension in patients with type 2 diabetes [38,39]. Diabetes is a metabolic disease characterized by chronic hyperglycemia. It is estimated that the worldwide incidence will increase from 171 million in 2000 to 366 million in 2030. Omega-3 fatty acids can improve the clinical conditions of diabetic patients, including their glucose tolerance, serum triglycerides, HDL-C, and prostaglandin production. Although the anti-inflammatory and triglyceride-lowering properties of long-chain Omega-3 polyunsaturated fatty acids (n-3 PUFAs) are clinically well established, its role in countering obesity and metabolic syndrome remains controversial. The possible mechanisms to improve the body composition and regulate the metabolism in association with obesity may involve the regulation of lipid metabolism and adipose hormones like adiponectin [17,18,40]. Docosahexaenoic acids (DHA) and Eicosapentaenoic acids (EPA) in Omega-3 fatty acids from fish oil cannot be produced by the human body and must be supplemented by diet. Beside fish oil, it can be found in flaxseed oil and nuts. It helps to fight against inflammation by inducing production of adiponectin in fat cells. However, there are studies that suggested the fish oil supplement could not improve insulin sensitivity in healthy people. But for those with metabolic conditions, it does increase the sensitivity.

CONCLUSION

Diabetic patients are prone to periodontitis and tooth loss. They will experience decrease in salivation production that gives them a burning sensation in the mouth, as well as other oral symptoms due to poor glycemic control. Diabetes can also delay healing, especially in the oral mucosa, causing nerve paresthesia and taste dysfunction, as gingivitis will invade the tissues around teeth. Fungal and bacterial infection, as well as lichen planus-like lesions and angular cheilitis, are common oral diseases in diabetic patients. Compared with healthy people, periodontal disease in diabetic patients is more severe and related to high level of HbA_1C. Diabetic patients, with high accumulation of glycation end products in the body, will have impaired WBC function, resulting in a body-wide inflammation, where coupled with the increase of dental plaques, the production of cytokines will cause inflammation in soft tissues to subject the gums and alveolar bones to infection and necrosis. When their blood sugar level is not well controlled, the saliva secretion will decrease, along with the ability to self-clean the oral cavity. Bacteria will thrive and multiply to cause dental caries, gingivitis, periodontal disease and other problems. Periodontal disease is by far the most common complication in diabetic patients because it will not only destroy the periodontal tissues to cause symptoms like swollen gums, bleeding, enlarged interdental spaces and atrophy of alveolar bones but also cause the teeth to fall out if severe. As a result, it is often recommended for the diabetic patients to pay attention to their oral health and hygiene. As the world population is aging, it is no doubt that there will be an increase in the number of people with periodontal disease and diabetes, where these conditions will heavily impact on the quality of life. Papers that evaluate and compare the current prevalence of periodontitis and diabetes in Taiwan and other countries in the world have shown the rate in the range of 29.7-43.1%, including 25-36% of the cases as moderate periodontitis and 5-7% of the cases as severe periodontitis. Nevertheless, the prevalence of the two diseases in Taiwan is no different from other countries in the world and falls within the average. Diabetes is known to cause and advance periodontitis, which in turn will disrupt the regulation of blood sugar, resulting in diabetic complications. Thus, it is important to treat such patients, not only to control their blood sugar but also to pay attention to dental care and be educated with specific emphasis on blood sugar control and oral hygiene.

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