

The Impact of Diabetes on Dental Health

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Abstract. Diabetes represents one of the most susceptible chronic diseases, encompassing an array of diverse complications. The lack of awareness regarding the detrimental effects of diabetes on dental health is evident therefore this article is to educate people regarding such condition. Currently, there is moderate evidence suggesting a significant impact of diabetes on dental health, Furthermore, it exhibits a pronounced association with periodontitis. as well as a bilateral relationship between periodontal disease and diabetes with each condition potentially exacerbating the other. The present article addresses the existing deficiencies in this field by incorporating an analysis of the impact of diabetes on dental health and proposing effective strategies for its management. The implementation of this approach may effectively contribute to a reduction in the prevalence of diabetes and promote dental health. For individuals diagnosed with diabetes, it enables them to gain awareness regarding the detrimental impact of diabetes on their oral health and take appropriate measures to mitigate such effects.

Keywords: Diabetes, dental Health, periodontitis, periodontal disease.

1. Introduction

Diabetes is detrimental to the human body and most symptoms of diabetes are feeling thirsty, urinate more frequently than usual, blurry vision, feeling exhausted, and lose weight unconsciously [1, 2]. As time goes on, the damage of diabetes to our body gets worse. It may harm the heart, blood vessels, kidneys, and nervous organs, leading to a higher potential of occurring healthy issue, such as the heart attack, cerebral stroke and CRF (chronic renal failure) [1]. Diabetes not only effect inner organs but also had a great impact on teeth as well. However, research into the prevalence of periodontitis and the incidence of diabetes across diverse population cohorts fails to yield consistent conclusions. Evidence pertaining to the influence of periodontitis on the development of diabetes-related complications is relatively scant. This essay will talk about the effects of diabetes on teeth in depth and how to prevent this happening.

2. Characteristics and Effects of Diabetes

Diabetes is a type of chronic disease which has different types and forms. There are two main types of diabetes: type 1 diabetes (T1D) and type 2 diabetes (T2D). There is also a gestational diabetes but it only happens during pregnancy. Both type 1 & 2 diabetes can happen during childhood and adulthood and T2D is more common in adulthood. However, due to the increase of obesity in children has led to growing cases of T2D in younger generations. Statistics showed that, in 2021, there are over 537 million people who are suffering from diabetes [3]. It is being predicted that this number will soar up to 643 million by 2030. Approximately 90% of people who have diabetes are T2D [3]. Not only is diabetes common but deadly as well. There are 1.6 million of people killed by diabetes up to 2021 [4]. In the United State, diabetes is estimated to account for 103,294 death certificates in 2021, ranking the eighth major causes of death [5].

Insulin is an indispensable hormone that assists our body to turn the food into energy and regulates the blood sugar level. When there is a lack of insulin, the body will not be able to regulate the blood sugar level, resulting in hyperglycemia. T1D occurs when the pancreas doesn't produce any more insulin. Whereas T2D typically occurs when there is a lack of insulin secreted by the pancreas or the body failed to utilize insulin that has been produced effectively and properly. Moreover, the symptoms of T2D is hard to discover at start, but it will become more obvious over time. Both type

1 & 2 of diabetes have no cure, the only solution to both types is to manage the amount of sugar intake through diet, lifestyle and eating habit.

Other than type 1 & 2 diabetes, Gestational diabetes is also a type of diabetes, in this case, it only happens during pregnancy. In the United State, an estimated 2% to 10% of US pregnancies were effected by gestational diabetes, posing a great threat to the pregnant ladies every year [6]. Gestational diabetes happens because of insulin resistance which makes the insulin in our body malfunction. Insulin resistance, also known as, impaired insulin sensitivity, means that the cells in our body doesn't respond to insulin properly and thus the insulin failed to regulate the blood sugar level and turn food into energy. And the exact cause of insulin resistance is unknown. The symptoms of gestational diabetes resemble the symptoms of hyperglycemia. It is unsure that the presence of gestational diabetes will have evident symptoms. However, having gestational diabetes will raise the risk of complications such as, depression, pre-eclampsia. People who had gestational diabetes and their children will have a higher chance of having T2D in the future.

3. Influence of Diabetes on Teeth

Diabetes may cause unhealthy teeth and mouth cavity. This damages to the body are much worse than what people expected. The damages that can cause by diabetes are dental caries and enamel erosion, periodontal disease, gum disease, infection. There is a bilateral causality between periodontal disease and diabetes and the periodontal disease includes: periodontitis, gingivitis, periodontal trauma, periodontal atrophy. Diabetes is a risk factor for exacerbating periodontal disease. Similarly, periodontal disease can worsen blood glucose control and accelerate the occurrence and development of diabetes complications. It is a destructive disease that occurs in the supporting tissue of gums such as: gums, alveolar bone, periodontal membranes) and it is one of the main causes of tooth loss.

3.1. Periodontitis

Due to hyperglycemia, diabetes will disrupt the microcirculation of periodontium causing significant damage. This has led to the fourth major complications of diabetes, periodontitis, which has a massive impact towards our health of teeth. Symptoms of periodontitis are as follows: gingival inflammation and bleeding, periodontal pocket formation, alveolar bone resorption, tooth loosening and displacement. The probability of diabetics having periodontitis is six times higher than that of a normal person. Moreover, periodontitis will be more severe for diabetics with poor blood glucose regulation or uncontrolled blood glucose level. Severe periodontitis causes red and swollen gingival margin with granulation-like hyperplasia. Moreover, the gingival margin will be prone to bleeding and recurrent periodontal abscess. Furthermore, the alveolar bone breaks down more rapidly. This is why diabetics will have a deeper periodontal pocket and obvious loosen of teeth

3.2. Loose Teeth and Loss of Teeth

Loose teeth are very common in Diabetes. There are lots of causes of loose teeth, including periodontitis, dental caries and such like. Because diabetics has symptoms of hyperglycemia, thus the blood sugar level is considerably high. This leads to the amount of sugar in our saliva increase and the small blood vessel in gum become diseased, resulting in a perfect condition for the breeding of bacteria and infection. With the addition of decreased immunity, it leads to the severity of inflammation and induces periodontitis. The repair and regeneration ability of mouth decrease, slowing down the healing of periodontal tissue. This also contributes to periodontal disease and dental caries. The periodontal disease give rise to bone atrophy of alveolar bone which leads to the loosening and loss of teeth.

3.3. Dental Caries and Enamel Erosion

Dental caries, also known as tooth decay, is a type of bacterial disease. As a result of that, it can cause pulpitis and periapical periodontitis. It can even lead to the inflammation of alveolar bone and

jawbone. If dental caries is not treated immediately, teeth cavity will be formed until the dental crown is completely broken and vanished. Teeth cavity will not recover spontaneously without treatment, and it will lead to loss of teeth eventually. People with diabetes often have symptoms such as insufficient salivation and dry mouth. This might be the cause of diabetic neuropathy, long-term hyperglycemia and such like. If there is insufficient salivation, the function of cleaning, lubricating, digesting and antibacterial by saliva will recede. This contributes to increase risk of gum infection. On the other hand, the oral environment of T2D is acidified which means the diversity and abundance of microbiota in our mouth is considerably low. This may lead to dental caries and enamel erosion.

4. Regulation and Intervention

Diabetes is a disease that is susceptible, yet numerous strategies exist for its prevention. The most efficacious approach involves improving dietary intake and lifestyle habits, in conjunction with enhancing public consciousness. Moreover, maintaining a healthy oral hygiene is also very important as periodontal disease can cause diabetes.

4.1. Altering Diet and Eating Habit

People should eat the same as what the dietary pagoda/guideline says whether they have diabetes or not. Dietary management and treatment are the essence of blood glucose control in patient with diabetes. If people want to avoid having diabetes, they should eat a variety of foods, not only staple foods. It is advisable to allocate staple food rations composed predominantly of whole grains and foods with a low glycemic index. People should consume more vegetables, milk, beans and fruits. Whereas oil, salt and sugar should consume less. While controlling blood glucose, people need to ensure the daily energy and nutrient intake is adequate. In accordance with the American Diabetes Association (ADA), individuals with diabetes are recommended to adhere to the diabetes plate for meal planning [7]. Begin with a nine-inch dish and allocate one-half of it to non-starchy vegetables, a quarter to lean proteins, and an additional quarter to well-selected carbohydrates such as starchy vegetables, fruits, whole grains, or low-fat dairy products [7]. As shown in figure 1.

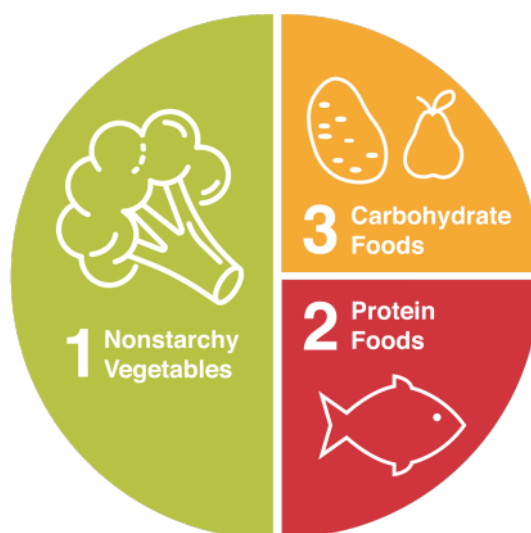


Figure 1. Diabetes Plate Method [7]

Meanwhile, diabetics should avoid eating instant oatmeal and multigrain powder that can be eaten when hot water is added. This is because the more finely ground the grain is, it is easier to digest and absorb, thus the higher the Glycemic Index (GI). When the GI is higher, it means that the body is faster in converting carbohydrate in a food into glucose which is bad for diabetics. Diabetics patient should have a light diet, limit alcohol consumption, prevent and delay complications. Consumption of alcoholic beverages can lead to an increase in blood glucose levels, with the excess energy from alcohol being converted into adipose tissue, thereby elevating the risk of hyperlipidemia. The liver

serves as the primary organ for the metabolism of alcohol; increased alcohol intake imposes a greater burden on the liver, potentially leading to liver damage, which, over time, may result in liver ischemia and even fibrosis.

Patients with diabetes must adhere to a regulated dietary guideline over a long period. Moreover, the consumption of alcoholic beverages can cause harm to the gastric mucosa, potentially leading to nutritional imbalances and, in severe cases, mortality caused by hypoglycemia.

4.2. Lifestyle

Having a healthy lifestyle is vitally important. Diabetics and normal people both should avoid sedentary behavior. Moreover, people should exercise regularly. For normal people, make sure there is a guaranteed 30 mins of exercise with suitable intensity. Similarly, for the majority of individuals with diabetes, it is recommended to aim for a duration of approximately 30 minutes per day, amounting to a minimum of 150 minutes weekly [8]. Besides, weight management is equally important. Preventing overweight and obesity may also reduce the risk of diabetes.

The regulation of emotions is of paramount importance and there is also a bilateral relationship between sleeping patterns and the risk of diabetes. A study published in "Sleep Health journal" discovered a "U-shaped" correlation between the duration of sleep and the risk of developing T2D, independent of other lifestyle habits [9]. This correlation indicates that both reduced and extended sleep durations are associated with an elevated probability of contracting T2D. Another study published in the "Journal of Clinical Medicine" indicates that not only is insufficient or excessive sleep detrimental, but also suboptimal sleep quality, which may elevate the risk of developing T2D [10]. Overall, there exists a significant correlation between the duration and quality of sleep and the risk of developing diabetes. thus, it is imperative to ensure an adequate amount of sleep and to seek timely therapeutic intervention for any sleep disturbances in order to enhance sleep quality. With respect to sleep duration, although individual sleep requirements vary, for the enhancement of health, it is advised that adults secure 7 to 9 hours of sleep per night; older adults aim for 7 to 8 hours; children aged between 6 to 13 should obtain 9 to 11 hours, and adolescents aged 14 to 17 necessitate 8 to 10 hours of rest each night [11].

4.3. Raising Public Awareness

Enhancing awareness contributes to an understanding of the risk factors correlating with diabetes, facilitates early detection of disease, and incentivizes lifestyle adjustments that may avert or postpone the onset of the disease. Studies indicate that once individuals become aware of having pre-diabetes, they are more inclined to undertake the essential long-term lifestyle modifications. These modifications encompass consuming a healthier diet, maintaining a suitable weight, protecting teeth and engaging in regular physical activity, which may contribute to the prevention or postponement of T2D. There are several ways to promote deeper understanding towards diabetes. The World Diabetes Day, as an example, specially established by the World Health Organization (WHO) and the International Diabetes Federation (IDF) in 1991, serves the purpose of heightening global awareness regarding the risks associated with diabetes. This observance is annually conducted on November 14th. This special day promotes public awareness and educate people about details and symptoms of diabetes through various of activities such as printing posters, completing a T2D risk assessment tool, taking diabetes education courses and suchlike, understanding how to reduce the risk of diabetes through diet, daily exercise and lifestyle. Organisation such as Diabetes UK, they post key information and symptoms of diabetes on social media through videos and blog. The Centers for Disease Control and Prevention (CDC) has awareness campaigns about diabetes which educates people about pre-diabetes through videos. There is also a 1-mins diabetes detection task that evaluate the risk of people getting diabetes. During courses, people can comprehend the importance of having a healthy lifestyle, diet and teeth when it comes to diabetes.

4.4. Protecting Teeth

As the essay mentioned before, there is a bilateral correlation between diabetes and periodontal diseases. Periodontal disease constitutes one of the most prevalent oral health concerns and one of the major causes of diabetes. To prevent periodontal disease, it is imperative to prioritize oral hygiene. It is essential brush teeth using Bass or Sulcular Brushing Technique every morning and evening. Especially brushing teeth before going to bed at night is more important than brushing your teeth in the morning. According to the oral health guide from National Health Commission of the People's Republic of China, it is advisable to rinse with water post-prandially thrice daily to eliminate dental deposits. Additionally, the oral health guide mentioned the utilization of dental floss can effectively clear food deposits from interdental spaces, thereby diminishing oral bacteria and avoiding inflammation. It is also crucial to chew correctly. It is advisable to distribute chewing evenly across both sides of the mouth during consumption. Unilateral chewing can lead to gum atrophy and loosening of teeth. The oral health guide also advice people to have the oral health examination once a year. At least once annually, the detection of oral diseases can be accomplished in a timely manner, enabling early treatment. Dentists will accordingly adopt suitable preventive strategies tailored to the specific situation, aiming to forestall the onset and manage the progression of oral pathologies [12].

Aim for a balanced diet that includes calcium-rich foods to reinforce dental strength. Incorporating foods high in protein, vegetables, and fruits, which are rich in vitamins, may further protect your teeth. Additionally, it is recommended to minimize the consumption of acidic foods, such as carbonated beverages, to maintain dental health. Furthermore, smoking constitutes a significant detriment to oral health. The cessation of smoking is imperative as it serves as a pivotal risk factor in the development of periodontal disease, significantly amplifying the likelihood of its occurrence among smokers by a factor of five when compared to non-smokers [12].

5. Conclusion

This article primarily explores the implications of diabetes on dental health, as well as potential strategies for mitigating or preventing such effects, and approaches to curtail the development of periodontal disease. Elucidating the detrimental effects of diabetes on dental health, as well as to foster a comprehensive understanding of the correlation between periodontal disease and diabetes. However, the specific mechanism of action of the two is still not fully understood, and there are few preclinical and clinical studies on the treatment options, efficacy and reliability of improving teeth, and evidence-based treatment has not been developed and needs further investigation in the future.

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