

Periodontitis, *Xerostomia*, and coated tongue as oral manifestations of type 2 diabetes mellitus

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World Journal of Advanced Research and Reviews, 2024, 23(03), 208–213

Publication history: Received on 22 July 2024; revised on 01 September 2024; accepted on 03 September 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.23.3.2591>

Abstract

Periodontitis, xerostomia, and coated tongue are oral conditions that often occur in type 2 diabetes mellitus patients. Type 2 diabetes mellitus is a major health issue that is often detected when the symptoms are getting worse. This case report aimed to discuss the association between oral pathology and type 2 diabetes. In this case report, the patient was 55 years old and had a chief complaint of teeth mobility since two years ago. The patient also had a history of type 2 diabetes mellitus since February 2023. The clinical examination showed that there was a gingival recession, teeth mobility, lesion on the tongue, and a decrease in salivary rate. The additional examination showed that there was bone resorption in all regions, and fasting blood glucose levels and lipid profile were higher than the normal limit. This study presented that there was an association between diabetes mellitus, periodontitis, xerostomia, and coated tongue through the increase of blood glucose, decrease of antibacterial effect, and decrease of oral hygiene.

Keywords: Diabetes Mellitus; Periodontitis; Xerostomia; Coated tongue

1. Introduction

Periodontitis is a chronic inflammation that causes the production of periodontal pockets, loss of connective tissue attachment, bone alveolar resorption, and loss of teeth in patients [1]. Periodontitis occurs in nearly 40% of the population worldwide, with a higher prevalence and severity in patients with diabetes [2,3]. The prevalence of periodontitis with diabetes was found for approximately 39%-59.6%. Poor glycemic control is correlated with the progression of the disease. The patients with diabetes or patients who had uncontrolled blood glucose levels had an increased risk of periodontitis of 2 to 3 times compared to those who did not have uncontrolled blood glucose levels [4]. However, many studies presented that diabetes mellitus has complex and multiple mechanisms for the development of periodontitis [5].

Xerostomia is one of the complaints that often occur in patients with diabetes [6]. The previous study showed that approximately 50% of patients with diabetes had a decrease in saliva or xerostomia [7]. This condition is caused by decreased saliva flow (hyposalivation) due to dysfunction of the salivary glands [6]. In diabetes mellitus, the disease can be caused by many factors, such as blood glucose level, polyuria, and the duration of diabetes mellitus [8]. Xerostomia may affect the decrease of antibacterial and self-cleansing ability, therefore increase the development of other diseases, including periodontitis and coated tongue [9].

An earlier study showed that coated tongue is one of the oral manifestations that can be found in 26.8% of 106 patients with diabetes. In addition, other studies also showed that a high prevalence of coated tongue was found in patients with type 2 diabetes mellitus [10]. Coated tongue is an accumulation of dead cells, debris, and protein located on the dorsum

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of the tongue. This condition may contribute to the progression of other oral diseases, including caries, periodontal disease, and halitosis [6]. Coated tongue is caused by a decrease in saliva flow and an increase in saliva's consistency which is also correlated with xerostomia [10].

Diabetes mellitus is a group of metabolic disorders that is characterized by an increase in blood glucose levels as a result of insulin resistance, insufficient insulin secretion, or both associated with disorders in carbohydrate, fat, and protein metabolism. The symptoms of diabetes that can be cured are an increase in thirst, increase in hunger, polyuria, and decrease in body weight, and sometimes can be accompanied by polyphagia, and loss of eyesight. Type 2 diabetes mellitus is the most common type of diabetes, approximately 90-95% of diabetes. This condition is characterized by insulin resistance and/or abnormal insulin secretion [5]. Type 2 diabetes mellitus is one of the major health issues. However, in the earlier stage, diabetes mellitus is often asymptomatic and only can be detected when the symptoms worsen. Therefore, the identification of oral manifestations in diabetes mellitus is important to be known as an effort to conduct early detection of diabetes mellitus [2].

This case report will discuss periodontitis, xerostomia, and coated tongue as oral manifestations in type 2 diabetes mellitus.

2. Case

2.1. Patient Description and Medical History

A patient, aged 55 years old, came to the Udayana University General Hospital with a chief complaint of teeth mobility in the upper and lower jaw. The teeth mobility occurred two years ago and has gotten worse since one month ago. The patient also complains of bad breath (halitosis) for a year. She did not do anything to reduce the complaint. The patient also had a feeling of hunger although she had already eaten something. This had happened for three years. She was diagnosed with type 2 diabetes mellitus in February 2023. The patient consumes antihypertensive, anti-cholesterol, and anti-diabetes medicines routinely. The last time she did the control was one week ago. The patient never goes to the dentist. She brushes the teeth twice a day, in the morning after breakfast and at night before going to bed. The patient did not smoke and did not consume alcohol. She admits no family member had history of diabetes mellitus.

2.2. Physical Examinations

Table 1 General Examination of the Patient

Blood Pressure	159/79 mmHg
Pulse Rate	82x/min
Respiratory Rate	18x/min
Temperature	36.5°C
Height	155 cm
Body Weight	50 kg

Extraoral examination showed that the patient had a symmetrical face without any swelling. The palpation examination showed the lymph nodes and salivary glands were not palpable and painless. The examination of the patient's lips and skin around the mouth showed that there were no abnormalities.

Intraoral examination showed that there was debris in all regions, dental calculus in the lingual and palatal of the maxilla and mandible, without any stain. Figure 1. Picture of oral mucous of the patient.

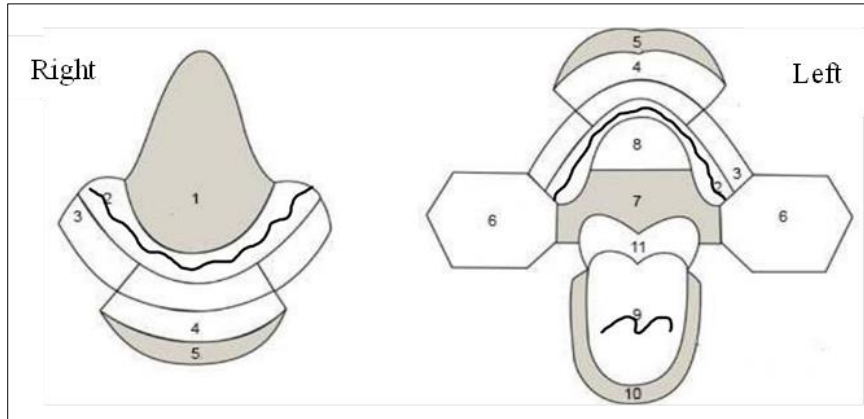


Figure 1 Oral mucous of the Patient

Remarks:

1. Ventral of the tongue/floor of the mouth
2. Gingiva
3. Vestibulum
4. Labial mucosa
5. Lips
6. Buccal mucosa
7. Soft palate
8. Hard palate
9. Lateral of the tongue
10. Dorsum of the tongue
11. Oro pharynx

According to the picture above, it showed that the patient had three lesions, two lesions on the gingiva and one lesion on the dorsum of the tongue. On the gingival of the maxilla and mandible, it was found that there was a gingival recession in all regions, with an average recession of 4 mm, the deepest recession is 10 mm, and the shallowest recession is 1 mm. On the two-third part of the dorsum of the tongue, there was a lesion with an irregular shape, white, smooth texture, unclear margin, irregular texture on the edge of the lesion, normal texture surrounding the lesion, and the white lesion that can be scrapped. The intraoral examination showed that the patient had a sticky, thick, and foamy salivary consistency. In addition, the buccal examination showed that the dental mirror adheres to both of the buccal mucosa of the patient. Meanwhile, oral mucosa, floor of the mouth, *orofaring*, ventral of the tongue, lateral of the tongue, hard and soft palate showed no abnormalities. Figure 2. Showed the intraoral condition of the patient.



Figure 2 Intraoral Condition of the Patient

The patient was then referred to receive a clinical pathology examination and panoramic radiographic examination to obtain better information regarding the patient's condition.

2.3. Clinical Pathology Examination

The clinical pathology examination showed fasting blood glucose is higher than the normal limit (175 mg/dL) and creatinine level is higher than normal (0.56 mg/dL) which indicates there was a decrease in renal function in the patient. Moreover, it was also found that the lipid profile (cholesterol 236 mg/dL; LDL 144.8 mg/dL; HDL 66 mg/dL) was higher than the normal limit.

2.4. Radiography Examination

Radiography examination showed that bone resorption occurred in all regions with an average of bone resorption of 5.6 mm. The shallowest bone resorption is 1 mm and the deepest is 10 mm. There is a radiolucent appearance with irregular and unclear margins in the coronal to apical root of the tooth 14 and 38 which indicates a periodontal abscess. There is a radiolucent appearance in two-thirds of the coronal root of the tooth 27 which indicates the dental caries in the root 27. There is a radix of tooth 46, edentulous ridge of teeth 18, 17, 35, 36, 37, 43, 44, 45. Figure 3. showed the result of the panoramic radiography examination.



Figure 3 Radiographic examination

2.5. Diagnosis

According to the subjective examination, clinical examination, and laboratory examination, the patient was diagnosed with chronic generalized periodontitis, xerostomia, and coated tongue which is related to type 2 diabetes mellitus.

2.6. Treatment plan

Communication, information, and education were given to the patient regarding the patient's condition. The operator must communicate to the patient that the patient has chronic generalized periodontitis, xerostomia, and coated tongue. This disease was related to the tissue surrounding the teeth, dry mouth, and fungus at the dorsum of the tongue. The patient also has diabetes mellitus and the patient must be informed to consult with an internist to obtain advice regarding the consumption of medicine and further treatment planning. Furthermore, the patient was referred to the periodontist to receive other treatments, such as scaling, root planning, splinting, and periodontal abscess treatment. The operator then educates the patient to always maintain oral hygiene.

3. Discussion

3.1. The influence of diabetes on periodontitis

Previous studies showed that there is no specific oral manifestation of diabetes mellitus. However, patients with diabetes are more likely to have an infection and probability of having severe periodontal disease [9]. Periodontitis is a chronic inflammatory disease caused by microbiota that can damage the periodontium of a vulnerable person. The clinical manifestation of periodontitis consists of gingival hemorrhage, the form of a periodontal pocket between the gingiva and the tooth, loss of clinical attachment, and loss of alveolar bone that can be assessed radiographically [5]. The previous study showed that the patients with diabetes had oral microbes that are more pathogen than the healthy patients so the patients had a higher risk of having periodontitis [3]. The high amount of periodontal pocket is caused by high level of glucose in the cervical fluid [9]. *Aggregatibacter actinomycetemcomitans* and *Capnocytophaga ochracea* are opportunistic anaerobic bacteria that develop in gingival pockets as a result of severe hyperglycemia [7].

Hyperglycemic also worsens bone quality and causes greater alveolar bone absorption in periodontitis. High glucose in diabetes patients may cause glycation of proteins known as AGE (Advanced Glycation End Products). The accumulation of excessive AGE may cause increased of periodontal tissue inflammation in diabetic patients. The binding between AGE and its receptor (RAGE) stimulates the production of inflammatory molecules such as, IL-1 β , TNF- α , and IL-6. This process causes increased oxidative stress due to the production of reactive oxygen species (ROS), which contributes to blood vessel destruction related to some diabetes complications and causes bone destruction [1, 3]. Patients with type 2 diabetes mellitus often have hyperlipidemia which is characterized by the increase of fatty acid and cholesterol, which is similar to our case. Hyperlipidemia can induce the inflammatory response of immune cells by the saturation capability of fatty acids that can stimulate TLRs (*toll-like receptors*) to induce inflammation [3]. Diabetes and periodontitis have two-sided interconnections. The increase of periodontitis is associated with the incidence of diabetes mellitus, and negative effects on diabetic conditions, including poor glycemic control and increased risk of diabetes. This may occur due to virulence factors of bacteria such as *lipopolysaccharide* (LPS), *peptidoglycan* (PGN), other cell surface components, and inflammatory mediators spread through the circulation and cause significant systemic inflammation [4, 5].

3.2. The influence of diabetes on xerostomia

Xerostomia was occurred in 40-80% of patients with diabetes and is associated with the decrease of salivary rate. Xerostomia can occur in controlled and uncontrolled type 2 diabetes patients [8]. According to a research, the diabetes mellitus patients who experience xerostomia have fasting blood sugar levels of more than 100 mg/dL [11]. This was similar to our patient who had a fasting blood sugar level of 175 mg/dl. Xerostomia in diabetic patients can occur due to disruption of gland function caused by the increase of glucose level which affects the consistency of saliva and increases its viscosity. Moreover, this condition leads to dehydration and damages the gland's function. In addition, chronic complications of diabetes such as endothelial dysfunction, microvascular complications, and neuropathy, may affect the microcirculation and change the composition of saliva [9]. Hyperglycemia can also cause an increase of diuresis which correlates with a decrease in extracellular fluid so it has a direct effect on decreasing saliva production [11, 12]. Xerostomia is characterized by dehydration, sensory dysfunction, changes in saliva composition, and a decrease in salivary rate. The oral mucosa is usually protected by saliva when the quantity and quality are adequate. Diabetes patients are at a higher risk of having mucosal abnormalities and other disruptions due to the salivary gland malfunction and immune system that was negatively impacted by diabetic conditions. The salivary gland may have a disruption in particular functions, such as protective functions and lubricant, a decrease in immunoglobulin A (IgA) secretions, an antibacterial effect, and a self-cleansing effect. The self-cleansing effect plays an important role in cleaning the oral mucosa and prevents the adhesiveness and growth of bacteria in hard and soft tissues of the oral cavity. Diabetes patients generally experience a decrease in salivary flow and an increase in the viscosity of saliva, resulting in decreased self-cleansing ability and reduced antimicrobial activity of the saliva [10]. The low self-cleaning ability in patients with xerostomia causes the patients to be more susceptible to dental caries, and periodontal disease, and tend to have poor oral hygiene. Poor oral hygiene can also contribute to a coated tongue [6, 7, 8].

3.3. The influence of diabetes on coated tongue

Coated tongue is an accumulation of dead cells, food debris, and protein on the dorsal surface of the tongue. This disease is characterized by the presence of a yellowish-white layer on the surface of the tongue which is an accumulation of debris, epithelium, and microorganisms on the tongue. This condition can influence the occurrence of periodontal disease and halitosis [6]. *Coated tongue* generally involves the two-thirds of the posterior part of the dorsum of the tongue, starting close to the foramen caecum and dorsum of the tongue and spreading to the lateral and anterior parts. Moreover, in this condition, the filiform papillae seem to elongate and reach the length of several millimeters, this may occur due to the non-desquamation of the keratinized epithelium in the filiform papillae [10].

There is an association between type 2 diabetes mellitus and xerostomia and coated tongue according to the level of glycemic control. Diabetes mellitus can affect immune responses, such as a decrease in chemotaxis and vascularization. Furthermore, this condition makes the individual susceptible to irritation in the oral cavity. The condition can disrupt cell desquamation and the proliferation of microorganisms, particularly on the surface of the tongue. Meanwhile, diabetes can also cause a decrease in salivary function so that the saliva cannot protect the oral cavity from bacterial and fungal colonization and defend against proteolytic attacks by microorganisms. The occurrence of xerostomia causes the decrease in IgA secretion which can neutralize the bacteria and inhibit bacterial adhesion to oral tissues [10].

The thickness of the coated tongue in diabetes mellitus patients is affected by blood glucose levels, salivary IgA levels, periodontal disease, and the patient's age. The level of poor glycemic control in diabetes mellitus patients affects the increase in oral manifestations. Moreover, IgA can inhibit bacterial adhesion thereby preventing bacterial colonization on the mucosal surface, eradicating the bacterial as a defense mechanism of soft and hard tissue, and also inhibiting and

reducing the bacterial resistance and accumulation of coated tongue [10]. A previous study showed that long-term diabetes mellitus patients have coated tongue with a more yellowish color on the dorsum part of the tongue than the patients who have a shorter duration of diabetes mellitus [12].

4. Conclusion

Periodontitis, xerostomia, and coated tongue are oral manifestations that often occur in type 2 diabetes mellitus patients. Uncontrolled glucose and lipid levels in diabetes patients may cause the patients more susceptible to suffering oral pathology conditions. There is an association between diabetes mellitus, periodontitis, xerostomia, and coated tongue through the increase of glucose levels, decrease of antibacterial effects, increased accumulation of AGEs, and decreased level of oral hygiene. Therefore, it is fundamental to know the oral manifestations of diabetes as early detection of diabetes and it is important to focus on oral and systemic rehabilitation to the patient.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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