

The effect of Xerostomia in diabetes mellitus patients on the incidence of dry socket after tooth extraction: A literature review

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Abstract

Background: Diabetes Mellitus (DM) is a metabolic disorder caused by the absence of insulin hormone production or lack of response to insulin. Diabetes mellitus can cause complications such as caries, periodontal disease, and xerostomia. Xerostomia is associated with low salivary flow which can cause several additional complications.

Objective: To determine the effect of xerostomia, a complication in patients with diabetes mellitus, on the incidence of dry sockets after tooth extraction.

Method: The method used in this study is a Literature Review, which searches three different journal databases, using the search terms "xerostomia" OR "diabetes mellitus" AND "tooth extraction" OR "dry socket."

Results: It shows that there is an effect between the occurrence of xerostomia in patients with diabetes mellitus and the incidence of dry sockets after tooth extraction.

Discussion: In patients with diabetes mellitus, saliva production can decrease due to nerve and blood vessel damage caused by glucose metabolism disorders in the body. This can reduce the quality and increase the viscosity of saliva, making the wound-healing process after tooth extraction more difficult. Xerostomia in patients with diabetes mellitus can worsen the dry socket condition because of the lack of moisture in the oral cavity, which can affect the blood clotting process after tooth extraction. If the blood clot dislodges, it can cause a dry socket in xerostomia patients.

Conclusion: Dry socket in diabetic patients with xerostomia is thought to be due to low saliva production which interferes with wound healing after tooth extraction.

Keywords: Diabetes mellitus; Dry socket; Tooth extraction; Xerostomia.

1. Introduction

Diabetes mellitus is a disorder of the endocrine system characterized by increased blood glucose levels. The main cause of diabetes is the absence of insulin hormone production, lack of insulin response, or both (1). Diabetes mellitus (DM) is a global disease that affects 1 in 11 adults, with around 90% having type 2 diabetes (2).

The World Health Organization (WHO) and the American Diabetes Association (ADA) use a classification of diabetes that combines two clinical stages of hyperglycemia and etiological type to determine the type of diabetes. There are two main subtypes of diabetes, namely type 1 and type 2. These two main subtypes are caused by problems with insulin production or action. Type 1 diabetes is caused by insulin deficiency due to damage to pancreatic beta cells and usually

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occurs in young people but can also occur at any age. Type 2 diabetes is the most common type of diabetes and is caused by the interaction between genetic factors and lifestyle or environmental factors (3).

In addition to these two main subtypes, diabetes can also be classified as gestational diabetes, neonatal diabetes, maturity-onset diabetes of the young (MODY), and diabetes caused by other diseases (2).

To diagnose a patient with diabetes, the guidelines used by the American Diabetes Association (ADA) require one of four criteria, namely (1) hemoglobin A1c (HbA1c) levels equal to or greater than 6.5%, (2) fasting blood glucose levels equal to or greater than 126 mg/dl, (3) blood glucose levels two hours after an oral glucose tolerance test equal to or greater than 200 mg/dl, or (4) if a person experiences symptoms of diabetes or hyperglycemic crisis and random blood glucose levels equal to or greater than 200 mg/dl are sufficient to diagnose a patient with diabetes (1).

Diabetes mellitus is a chronic disease characterized by high blood sugar levels over a long period. Diabetes can cause various complications in quite serious organs of the body, such as complications in the microvascular system, namely retinopathy, neuropathy, and nephropathy (4). In addition, one of the complications of diabetes mellitus that can occur in the oral cavity is xerostomia or dry mouth. Xerostomia usually occurs in 40-80% of diabetic patients. The causes include changes in the salivary glands, glycosuria or polyuria, neuropathy, angiopathy, and decreased enzyme activity in the salivary glands (5).

1.1. Tooth Extraction

Tooth extraction is a treatment procedure that is quite often performed by a dentist. Extraction is the removal of teeth and tooth roots from their sockets involving bone and soft tissue in the oral cavity and the process can be complicated by factors such as movement of the lower jaw and lips (6). The number of teeth extracted or pulled in a population can be an important benchmark in determining the degree of dental and oral health. Generally, the condition of the extracted teeth reflects the presence of dental caries and periodontal disease that is already classified as severe. Tooth extraction can also be used as a benchmark for the level of knowledge and motivation of the community in maintaining their teeth. The higher the extraction rate in a community, the lower the level of knowledge and motivation of the community in the field of dental and oral health in that area (7). Extraction is more often performed by patients in the elderly group (elderly) compared to other age groups (8). Tooth extraction is categorized into two types, namely simple extraction and surgical extraction. A simple extraction is an extraction performed on teeth that are visible in the oral cavity, using local anesthesia and using tools to elevate the visible part of the tooth. A surgical extraction is an extraction performed on teeth that cannot be easily reached because they are below the gingival line or the teeth have not erupted completely. In surgical extraction, an incision is made in the gums to reach the teeth. In some cases, the teeth must be broken into several parts before being extracted (9).

1.2. Dry Socket

Dry socket or local osteitis is an inflammatory condition of the alveolar bone layer that covers part or all of the tooth socket (lamina dura) (10). A dry socket is one of the complications that often occurs after tooth extraction where the blood clot that forms in the socket of the extracted tooth is lost or released, causing exposure of the bone that is exposed and causes pain. Dry socket mainly occurs in the third molars which is characterized by severe pain on the 2nd to 4th day after tooth extraction (11). Dry socket complications can cause dull pain that can spread to the temples, eyes, or neck. In addition, a dry socket is usually accompanied by bad breath (10).

Injury during the tooth extraction process can increase the risk of alveolar osteitis or dry socket (12). In general, the exact etiology of dry sockets is still unknown, but there are several predisposing factors. One of them is the increase in fibrinolysis activity during the tooth extraction process, thus accelerating the process of dissolving blood clots that have formed (13). Several factors that can increase fibrinolysis activity include the use of anesthesia with excessive vasoconstrictors so that blood supply is blocked to the tooth extraction area, certain systemic drugs, body fluid activators, tissue activators, and bacteria that can cause pain, bad breath, and discomfort (10). Patients with systemic diseases such as diabetes or other immune system disorders tend to have a higher risk of developing alveolar osteitis after tooth extraction. Smoking and older age can also increase the risk (11). Symptoms that can be caused by dry socket complications include empty tooth marks without blood clots, visible bone or food residue attached, and pain when touched. In addition, Alveolar Osteitis usually does not show signs of fever or lymphadenitis, there is only erythema and slight edema in the soft tissue around the tooth socket (11).

2. Material and methods

The method used in writing this article is a literature review. Literature searches were conducted using the PubMed, ScienceDirect, and Google Scholar databases. The strategy in data collection was to write keywords used to search for articles to be reviewed with a publication period between 2016-2023. The keywords used were "xerostomia", "diabetes mellitus", "dry socket", and "tooth extraction".

3. Results

A study shows that people with diabetes experience a decrease in salivary flow rate compared to people without diabetes. This may be due to several factors such as polyuria (frequent urination), autonomic neuropathy, and medications that cause dry mouth. Decreased saliva production in people with diabetes can cause oral health problems such as tooth decay, infection, and dry sockets after tooth extraction. In conditions of tooth extraction, low saliva production can interfere with the wound-healing process and cause a dry socket, a condition in which the extracted tooth becomes open and infected (14).

Based on research by Sadrabad *et al.*, (15) several studies have shown a direct relationship between the occurrence of xerostomia in diabetics. 76% of type II diabetics experience xerostomia, while the prevalence of xerostomia in type I diabetics is 64%. This shows that xerostomia is a common problem in diabetics, both type I and type II. This can cause more serious oral health problems, such as tooth decay, infection, and dry socket after tooth extraction.

Based on the results of the study by Jallo Lourdes showed that one of the most common oral manifestations in diabetic patients is a dry socket or dry socket due to decreased blood supply to the socket and decreased wound healing after tooth extraction due to xerostomia (16).

Another study conducted by Rohani showed that patients with diabetes mellitus often experience salivary dysfunction which can cause decreased salivary flow and changes in saliva composition (17). The estimated universal prevalence of xerostomia among diabetic patients ranges between 34% and 51%. This study showed that there was a significant relationship between the level of xerostomia and glucose levels in saliva. Especially the level of salivary dysfunction is most observed in diabetics with poor glycemic control. Several studies explain that several factors can trigger a decrease in saliva secretion in DM patients, namely the aging process and the duration of suffering from DM. Most DM patients consist of the elderly and as age increases, it will cause changes and decline in the function of the salivary glands so that there is a risk of decreased saliva production. The condition of xerostomia in DM patients also depends on blood glucose levels where patients with fasting blood glucose levels ≥ 100 mg/dl and blood sugar 2 hours after eating ≥ 140 mg/dl have a higher risk of developing xerostomia (18).

4. Discussion

Xerostomia is a subjective complaint characterized by dry mouth and frequent hyposalivation or decreased salivary flow rate. Xerostomia is often associated with dysfunction of the salivary glands, but to confirm the diagnosis, further examination is needed, one of which is by conducting a sialometry examination. Xerostomia is characterized by hyposalivation, a condition when the salivary flow rate is below 0.1 mL/minute in unstimulated saliva or below 0.7 mL/minute in stimulated saliva (19).

The average salivary flow rate in male DM patients is 0.15-0.27 mL/minute while in female patients it is 0.13-0.22 mL/minute. The prevalence of xerostomia in DMT1 is reported to be 53% while in DMT2 it is 14-62% (18).

The autonomic nervous system, both sympathetic and parasympathetic, regulates saliva secretion. Stimulation of the sympathetic nerves will affect the levels and composition of salivary proteins, while the parasympathetic nerves will increase the volume of saliva secretion (20).

According to Ahmad *et al.*, (14), people with diabetes mellitus often complain of dry mouth or xerostomia and experience impaired salivary gland function. In people with type 1 DM, xerostomia is a common complication depending on glucose control. In type 2 DM, saliva secretion is influenced by autonomic neuropathy and drugs that can cause xerostomia (14).

Saliva plays an important role in maintaining the moisture of the oral cavity and providing nutrition to the soft tissues involved in the wound healing process (21). In people with diabetes mellitus, saliva production can decrease due to

nerve and blood vessel damage that occurs due to impaired glucose metabolism in the body. This can result in a decrease in the quality of the saliva produced and a thicker consistency of saliva, complicating the wound healing process after tooth extraction. Xerostomia in people with diabetes mellitus can worsen dry socket because lack of moisture in the oral cavity can affect the process of blood clot formation after tooth extraction. If the blood clot does not form properly or is easily dislodged, this can cause a dry socket in patients with xerostomia (22).

DM patients have a higher risk of experiencing xerostomia because high blood glucose levels can damage the salivary glands. According to a systematic study and meta-analysis by Li *et al.*, (23) conducted in 13 studies, DM patients have a higher risk of experiencing dry sockets after tooth extraction, and this condition is supported by xerostomia conditions that can increase this risk. Xerostomia in DM patients can reduce the production of saliva needed to maintain oral moisture and prevent infection (23).

Although xerostomia and dry socket are closely related in DM patients, this relationship is still not fully understood. However, recent studies have shown that xerostomia can affect the quality of life of DM patients and contribute to the development of oral lesions in DM patients. According to a study by Vaz *et al.*, (24), which was conducted on 100 DM patients, xerostomia and low salivary flow rate can contribute to the development of oral lesions in DM patients (24).

Preventive efforts to improve the quality of dental and oral health are needed in DM patients to prevent xerostomia and dry sockets. Improving blood sugar control can also help reduce the risk of xerostomia and dry socket in DM patients, as suggested by Farah *et al.*, (25) in their study on the relationship between salivary flow rate and blood sugar control in DM patients.

In patients with diabetes mellitus, there is an increase in blood glucose levels which can affect blood circulation and the wound healing process. Decreased blood flow to the area undergoing the wound healing process after tooth extraction can worsen the condition and trigger a dry socket. In addition, high glucose levels can also trigger infections in areas that have undergone tooth extraction and worsen dry socket conditions (26).

Based on research conducted by Kartimah, she explained the causes of xerostomia in patients with Diabetes Mellitus. According to her, xerostomia in DM can occur due to congenital neuropathy or due to damage to the VII cranial nerve (facial nerve) and IX cranial nerve (glossopharyngeal nerve), namely the nerves that innervate the parotid glands (69%) the source of saliva production (27).

Based on a study of DM patients, shows that the longer the patient suffers from DM, the greater the likelihood of suffering from xerostomia. This is supported by the theory that atrophy occurs in the salivary glands according to age which can reduce saliva production and change its composition. As age increases, the aging process occurs. There are changes and declines in the function of the salivary glands, where the parenchymal glands are lost and will be replaced by connective tissue and fat. This condition results in a reduction in the amount of saliva flow (27).

Patients with diabetes mellitus (DM) who experience xerostomia or dry mouth have a higher risk of experiencing dry sockets. Therefore, efforts to prevent and treat dry sockets in DM patients who experience xerostomia need to be carried out (28).

Prevention efforts can be made by increasing moisture in the oral cavity by drinking more water or using drugs that can increase saliva production. In addition, DM patients need to keep their blood sugar levels under control to prevent dry sockets (29).

Treatment of dry sockets in DM patients who experience xerostomia can be done in several ways, including administering analgesics and antibiotics, as well as proper dental care. The administration of analgesics aims to reduce the pain that arises due to dry sockets. The administration of antibiotics aims to reduce the risk of infection in the wound. In addition, proper dental care, such as cleaning the infected tooth cavity and covering it with a special bandage, can also help the healing process of dry sockets in DM patients who experience xerostomia (30).

5. Conclusion

The occurrence of dry sockets after tooth extraction in patients with diabetes mellitus who experience xerostomia is thought to occur due to low saliva production which can affect the wound-healing process after tooth extraction. Saliva plays an important role in maintaining oral moisture and helping the wound-healing process by providing nutrients and growth factors. In patients with diabetes mellitus who experience xerostomia, saliva production is reduced, thus affecting the wound healing process after tooth extraction and triggering dry socket.

Compliance with ethical standards

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