



ORTHODONTIC ATTENTION IN DEALING WITH DIABETIC PATIENTS

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ABSTRACT

Diabetes mellitus (DM) is a group of metabolic diseases resulting from defects in insulin secretion, insulin action or both and is characterized by hyperglycemia. The prevalence of DM is growing rapidly worldwide and is reaching epidemic proportions. Since DM cannot yet be cured, the symptoms of the disease and its complications can only be treated. The earlier the disease is diagnosed, the higher the prognosis of the patient, since complications within the early stage of the disease are less severe and more readily treated. This article deals with the various aspects of diabetes mellitus, its oral manifestations and treatment considerations.

KEYWORDS: Diabetes, treatment guidelines, tooth movement.

INTRODUCTION

The majority of patients who are treated orthodontically are healthy young individuals. However, the last 20 years has seen a dramatic increase within the number of adult patients striving treatment. Many of them affected by chronic diseases. Advances within the management of the various of these maladies have allowed these patients to pursue elective orthodontic procedures that only years ago would be considered contraindicated. One of the such disease is diabetes mellitus (DM). The practitioner should therefore understand the results of DM in reference to treatment and will have a basic knowledge and understanding of this disease and its impact on the mouth.

Incidence and Prevalence

Diabetes affects individuals of all ages, with a peak incidence within the fifth decade of life. The incidence of diabetes increases with age and since the life expectation of the population increases, the amount of diabetes patients will increase also. In 1997, an estimated 124 million people worldwide had been diagnosed as diabetics, and by the year 2010, the entire number of individuals with diabetes is predicted to succeed in 221 million. Approximately 3% to 10% of all diabetics have type 1 diabetes.^[1]

The incidence of type 1 diabetes varies dramatically among racial groups and countries.^[2] There is a transparent difference between the northern and southern hemispheres, with a high incidence for the people of Europe and North America. In general, boys and girls are at equal risk of developing type 1 diabetes. A little percentage of people, however, do develop this sort of diabetes during adulthood.^[3] Type 2 diabetes may be a global ill health of enormous magnitude that's calculated to affect 5% to 7% of the world's population.^[4] This prevalence could also be an underestimate, because many cases, even up to 50% in some populations, remain undiagnosed.

Type 2 diabetes in children was thought to be rare and to account for fewer than 5% of all cases of childhood diabetes.^[5] High caloric diet, decrease in physical activity, and mental stress may contribute to the present increase of type 2 diabetes in children and adolescents.

Etiology of Diabetes Mellitus

Several pathogenetic processes could also be involved within the development of diabetes such as:

- Genetic defects,
- Primary destruction of islet cells by inflammation, cancer, Surgery and trauma,

- A complication of endocrine disorders like anterior pituitary gland hyperfunction (overproduction of somatotropin, acromegaly), Cushing disease, and pheochromocytoma,
- Iatrogenesis after the administration of corticosteroids

Classification of Diabetes Mellitus

Recent Classification of DM supported the Etiology of the Disease

1. Type 1 DM: juvenile onset diabetes or insulin-dependent diabetes mellitus (IDDM). (beta cell destruction, usually resulting in absolute insulin deficiency)
 - A. Immune mediated
 - B. Idiopathic
2. Type 2 diabetes mellitus: maturity onset diabetes or type II diabetes mellitus (NIDDM) (may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance)
3. Other specific types
 - A. Genetic defects of cell function
 - B. Genetic defects in insulin action
 - C. Diseases of the exocrine pancreas
 - D. Endocrinopathies
 - E. Drug- or chemical-induced
 - F. Infections
 - G. Uncommon sorts of immune-mediated diabetes
 - H. Other genetic syndromes sometimes related to diabetes

4. Gestational DM

1. Type 1 diabetes mellitus: is usually referred to as juvenile onset diabetes or insulin-dependent diabetes mellitus (IDDM). It is prevalent among young individuals commonly below the age of 20 years, but can occur as late because the fourth decade of life. The cause is an absolute deficiency of insulin secretion.

Type 1 DM results from T-cell mediated autoimmune destruction of pancreatic beta cells leading to inability of the body to secrete insulin, learning the patient totally hooked in to exogenous insulin.

2. Type 2 diabetes mellitus: on the opposite hand, starts insidiously commonly beyond the age of 40 years as a results of a mixture of insulin resistance, glucagon excessive secretion and insulin inadequate secretion from pancreatic beta cells of Langerhans.

Type 2 DM is additionally called “maturity onset diabetes” or “non-insulin-dependent DM (NIDDM)”

Beside type 1 and type 2, comes another specific sort of diabetes that happens exclusively during pregnancy called as “gestational diabetes”. Females who are

genetically predisposed to diabetes can develop DM during pregnancy because the hormonal changes occurring during pregnancy make this stage of reproductive life diabetogenic.

Dental Complications of DM

1. Mouth dryness and burning (xerostomia)
2. Oral acetone smells in poorly controlled patients
3. Brittle teeth
4. increase in caries susceptibility
5. Recurrent oral infections, e.g. oral candida
6. Mouth ulcerations
7. Altered taste
8. Delayed healing of mucous membranes
9. Teeth disposition and misalignment
10. Periodontitis
11. Gingivitis, several studies show that gingivitis is more severe in children with diabetes and increases in severity with increasing blood sugar levels.^[6]
12. Vascular changes, like diabetes-related microangiopathies, are liable for complications in many organs like the retina (retinopathy) and therefore the kidney (nephropathy). Vascular changes also seem to favor progression of periodontitis.^[7]

Pathophysiology of Dental Complications of Diabetes Mellitus

Diabetes mellitus has major negative health consequences including microvascular, macrovascular, and neuropathic complications. It is a systemic disease that affects almost every single system from cutaneous to renal systems; it also causes severe dental dysfunction. Many theories had been proposed to explain the pathophysiology of dental complications of diabetes.

Diabetic-related microangiopathy remains the widely accepted theory. In DM, the tiny and medium blood vessels are specifically affected. Such microangiopathy leads to a substantial decline of blood flow to the supplied organs and tissues. The compromised vascular supply to teeth and dental structures leads to ischemic toothache, tenderness of gums, bone erosions, and even teeth loss.

Polymorphic dysfunction is another pathophysiological mechanism involved in dental poor health among diabetes that facilitates recurrent oral infection. Hyperglycemia also impairs Protein metabolism, enhances collagen breakdown and eventually delay healing. Table No 1 summarizes the pathophysiological mechanisms involved in dental complications among.

Table 1: Pathophysiology of Dental Complications of Diabetes.

Prompted mechanism	Pathophysiology and impacts
Diabetic microangiopathy	Small and medium sized vessel angiopathy Decline blood flow to dental structure Ischemic tooth ache Tenderness of gum Bone erosions Teeth loss
Polymorphic dysfunction	Recurrent oral ulcers
Protein metabolism impairment	Collagen breakdown and delayed healing

Review of Literature

Rylander and colleagues,^[8] confirmed vascular changes also seem to favour progression of periodontal disease. They compared the periodontal condition of 46 insulin-controlled young diabetics with 41 healthy young adults. They reported significantly more gingival inflammation in those young diabetics with retinopathy and nephropathy compared with diabetics with no complications like retinopathy and nephropathy. Holtgrans and Donath,^[9] were Studied Periodontal reactions to orthodontic forces. They found a retarded osseous regeneration, a weakening of periodontal ligament and microangiopathies within the gingival area. The authors concluded that the specific diabetic changes in the periodontium are more pronounced following orthodontic tooth movement.

Sastrowijoto and colleagues,^[10] demonstrated that an improved metabolic control in diabetes type 1 patients did not improve the clinical periodontal condition. The periodontal condition only ameliorates when local oral hygiene measures are intensified. Braga et al,^[11] in their study on a mouse model declared that diabetes had a major negative impact on alveolar bone remodeling and that the reversal of diabetes was associated with a significant improvement in bone health and reduction of teeth inappropriate movement.

There is no limit for orthodontic treatment; therefore the practitioners are going to be confronted in his office with type I also as type 2 diabetes patients. Diabetes type 2 patients can be considered more stable when compared with type 1 patient. Diabetes type 1 in more often

encountered in younger patients who will be more frequently selected for orthodontic treatment.

Diagnosis of Diabetes

Common clinical manifestations of diabetes include

- Polyuria,
- Polydipsia,
- Polyphagia,
- Generalized fatigue
- Weight loss.
- Diabetic ketoacidosis
- Recurrent infection especially of the cutaneous and mucous membranes

Clinical suspicion of diabetes mellitus warrants carrying out particular lab investigations to establish or exclude the diagnosis of diabetes.

The American Diabetes Association (ADA) established diagnostic criteria for diabetes mellitus that include elevated fasting plasma glucose level of 126 mg/ dL (7 mmol/L) or more, elevated 2-h plasma glucose level above 200 mg/dL (11 mmol/L) during conducting an oral glucose tolerance test (OGTT) with 75 g glucose, or an elevated random plasma glucose above 200 mg/dL (11 mmol/L) in clinically suspected patients.^[12]

Gestational diabetes mellitus on the other hand, is defined by the WHO as the WHO definition of gestational diabetes is fasting blood sugar of ≥ 126 mg/dL (7 mmol/L) or a 2-h level of ≥ 140 mg/dL (7.8 mmol).^[13]

WHO criteria (1999) for diagnosis of Diabetes by oral GTT is given in [Table No 2]

Table No 2: WHO criteria (1999) for diagnosis of Diabetes by oral GTT		
Venous plasma (Whole blood) glucose concentration mg/dl		
	OVERT DIABETES	IMPARED GLUCOSE TOLERANCE
Fasting	>110 (>126)	--
2 hr after 75 gm oral glucose	>200 (>180)	2 hr value 140-200 (120-180)

For professionals, the method of choice in monitoring the treatment of diabetes is the determination of the glycosylated hemoglobin concentration (HbA1c). Two different tests are available, the HbA1 and the HbA1c test; the HbA1c is more commonly used.

Glycosylated hemoglobin is an irreversible adduction of glucose to hemoglobin. The concentration of this compound is directly related to the rise in blood glucose over an interval of time. There is a linear rise in HbA1c as the blood sugar increases in diabetic patients. Since the lifespan of the erythrocyte is about 120 days, a change in HbA1c can be observed only after several

weeks if the ambient blood sugar concentration is changed.

Glycosylated Hemoglobin Assay (HbA1c)

- 4% to 6% - Normal
- <7%-Good diabetes control
- 7% to 8% - Moderate diabetes control

Therefore, HbA1c is extremely useful for the assessment of glycemic control over a 6- to 12- week period in patients with either type 1 or type 2 diabetes. An HbA1c of less than 7.5% or of more than 9% indicates, respectively, a good or a poor control of diabetes.

Orthodontic consideration in diabetic patients are summarized in [Table No 3]

Table No 3: To summarize Orthodontic Consideration in Diabetic Patients	
Considerations prior to deciding orthodontic treatment	Practice good oral hygiene and dental health (most potent) Proper control of diabetes Exclude periodontitis Monitoring of blood glucose before going into active orthodontic treatment
Considerations during orthodontic treatment	Apply light physiological forces Prophylactic antibiotics before: orthodontic bed placement; separator placement; screw insertion Antibiotic prophylaxis is not needed in: simple adjustment of appliances; simple replacement of appliances
Considerations to avoid or manage emergencies during the process (especially hypoglycemia)	Morning meal on day of orthodontic treatment If symptoms of hypoglycemia occurred: IV dextrose; IM glucagon 1 mg

Orthodontic Treatment Consideration in Diabetic Patients

1. The key to any orthodontic treatment for a patient with diabetes is good medical control. If the patient is not in good metabolic control (HbA1c9%), every effort should be made to improve the diabetic state before starting orthodontic treatment. Orthodontic treatment should be avoided in patients with poorly controlled Insulin-dependent DM as these patients are particularly vulnerable to periodontal breakdown.^[14]

2. It is important to stress good hygiene, especially when fixed appliances are used. Indeed, such appliances may produce to increased plaque retention, which can in these patients more easily cause cavity and periodontal breakdown.

3. Adjuvant daily rises with a fluoride rich mouth rinse, preferably before bed time, can provide further preventive benefits.

4. If plaque control is difficult to achieve with mechanical aids such as toothbrush and interdental brush, the use of a disinfectant mouth rinse of the chlorhexidine type, as an adjuvant chemical plaque control, can be considered. To minimize the neutralizing effect of the toothpaste on the chlorhexidine molecule, there should be at least a 30-minute interval between toothbrushing and a chlorhexidine rinse.¹⁵ Chlorhexidine is cationic and forms salts of low solubility with anions, leading to a reduced antimicrobial effect. Sodium lauryl sulfate, which is widely used as a detergent in toothpaste, is anionic.

5. Candida infections may occur and, if present blood glucose level should be monitored to rule out deterioration of the diabetic state.

6. Diabetes related microangiopathy can occasionally occur within the periapical vascular supply leading to unexplained odontalgia, percussion sensitivity, pulpitis or maybe loss of vitality in sound teeth. Orthodontist should remember of this phenomenon and regular vitality check- ups are advised.

7. The most common complication seen in diabetic patients is hypoglycemia. When planning dental treatment, it's best to schedule appointments before or after periods of peak insulin activity. This requires knowledge of the pharmacodynamics of the drugs being taken by the diabetic patient.

8. Morning appointments are preferable. If the patient is scheduled for an extended treatment session, that is, longer than 1½ hours, the patient should be advised to eat their usual meal and take their medication as usual. Before the procedures starts, the orthodontist should check whether the patient has fulfilled these recommendations or not. In this way a hypoglycemic reaction in the office can readily be accorded.

9. Children with diabetes are at nutritional risk and should undergo nutrition screening to identify those who require formal nutrition assessment with development of a nutrition care plan.

10. Since diabetic patients and, more specifically, uncontrolled or poorly controlled diabetic patients have

an increased tendency for periodontal breakdown, these patients should be considered within the treatment plan, as periodontal patients and treatment considerations accordingly be made.

Especially in adults, it's important before the beginning of treatment to get a full mouth periodontal examination including probing, plaque and gingival score, and to gauge the necessity for periodontal treatment. First the periodontal condition should be unproved before any orthodontic treatment can take place. During treatment the orthodontist should monitor the periodontal condition of patient with diabetes and keep control over the inflammation.

11. It is advisable to use light forces and not to over load teeth. diabetes-related low blood flow to teeth and dental tissue, dentists should take into consideration that diabetic patients' teeth are fragile and thus apply as light physiological forces as possible not to overload the already compromised teeth.^[16]

CONCLUSION

Diabetes mellitus is commonly experienced in patients seeking orthodontic treatment. Because diabetes impose a considerable negative effect on bone remodeling, diabetic patients' teeth are very likely to be misaligned and to require correction. Thus, it is important for dentists to have basic and solid background knowledge about diabetes diagnosis, management, dental consequences, and the considerations to be taken into account during treating those patients.

It is necessary for an orthodontist to recognize the processes and significance of different systemic disease. Patient cooperation, consent of patient before treatment, proper referral when required and constant monitoring of the progress of the treatment are requisite to minimize physical damage and to enhance treatment outcome. While performing orthodontic treatment, careful and practical selection of the treatment objectives, timing of treatment and type of appliance is must in each patient.

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