



## Impact of Type 1 Diabetes Mellitus on the Oral Health of Children –A Review

Dr. Indira Mysore Devraj<sup>1\*</sup>, Dr. Samredhi Singh<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Pediatric and Preventive Dentistry, JSS Dental College and Hospital, JSS Academy of Higher Education & Research, Karnataka, India

<sup>2</sup>Undergraduate Student, Department of Pediatric and Preventive Dentistry, JSS Dental College and Hospital, JSS Academy of Higher Education & Research, Karnataka, India

### \*Corresponding Author

**Dr. Indira Mysore Devraj**

Associate Professor, Department of Pediatric and Preventive Dentistry, JSS Dental College and Hospital, JSS Academy of Higher Education & Research, Karnataka, India

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**Abstract:** Diabetes mellitus (DM), is a metabolic disorder occurring when there is decreased production of insulin hormone or if there is poor body response to it. Type 1 DM is most common in children and adolescents and has a strong impact on their lifestyle. Conflicting evidence is available in the scientific literature on caries prevalence in children with diabetes and healthy children. Many studies have also reported higher plaque accumulation with greater gingival index scores in children with diabetes. Diabetes Mellitus plays a very noteworthy role in oral complications and therefore it becomes important for health practitioners to take good care of these children's general and oral hygiene.

**Keywords:** Diabetes Mellitus, Oral Health, oral hygiene, Children.

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## INTRODUCTION

Diabetes mellitus (DM), a metabolic disorder occurs because of several interferences in the catabolism and anabolism of fat, carbohydrates and proteins which eventually occurs when there is decreased production of insulin hormone or if there is poor body response to it [1]. Diabetes Mellitus is categorized as Type 1, where Insulin production by pancreatic beta cells is negligible; Type 2, where the beta cells are insufficient or the tissue sensitivity must be decreased with insulin for disease substantiation. The other forms of diabetes are Gestational diabetes, defined as the glucose intolerance level with onset or early detection during pregnancy; and discrete diabetes caused by numerous factors, like disease of the exocrine pancreas, monogenic diabetes syndromes, drug/chemical-induced diabetes (with glucocorticoid use, HIV/AIDS/ post organ transplantation) [2].

Recent Global data states that this disorder affects 415 million people worldwide and will further reach up to 642 million by 2040 [3]. Diabetes is an

expanding epidemic disease with a count of greater than 62 million diabetic individuals in India itself. In 2000, India ranked the highest across the globe with the maximum number of people affected with diabetes mellitus (31.7 million) followed by China (20.8 million) and the United States (17.7 million) [4]. Frequency rate of diabetes mellitus in Indians is 12-17% in urban and 2.4% among rural population. In India, the occurrence of juvenile diabetes (onset below 15 years), ranges from 0.8 to 3.61% [5]. Similarly, Karnataka state reports > 14% of women and >15.6% of men to have blood sugar levels >140mg/dl.

Type 1 diabetes mellitus is a chronic self-destructive disorder of pancreatic beta cells causing insulin insufficiency which further affects the peripheral system. Diabetes mellitus affects the whole body drastically and has many complications like Neuropathy, Nephropathy, Retinopathy, Cardiomyopathy, Periodontitis, Diabetic ketoacidosis and Diabetic foot disease.

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### **Impact of Diabetes Mellitus on Oral Health**

Oral health is defined as “the degree to which individuals can obtain, process and understand basic oral and craniofacial health information and services needed to make an appropriate health decision [6]. Oral health becomes a prime concerning factor when the child is suffering from diabetes mellitus. Drastic metabolic changes in the body of the child suffering from diabetes mellitus such as the increased formation of advanced glycation end-products AGEs, Promote the PKC activation pathway, increased ROS activity in mitochondria and increasing polyol pathway conversion bring about many oral complications [7].

The tissues and organs with affluent blood supply like kidneys, eyes and nerves are mainly affected by diabetes mellitus. The oral cavity which is lined by epithelial tissues rich in minute blood vessels also gets infected [7]. Dental caries gingival and periodontal diseases, decreased salivary flow rate, Oral Lichen Planus, candidiasis, altered taste, and impaired healing of wounds are some of the common oral signs and symptoms noted in diabetes mellitus [8, 9].

### **Diabetes Mellitus Effect on Eruption of Teeth**

Eruption is the movement of the tooth from its developmental position within the jaw to its functional position in the oral cavity. It's a physiological process of growth where the tooth pierces through the oral mucosa and no inflammation is seen under normal conditions. However in children with diabetes mellitus due to metabolic instability, there is decreased resistance to inflammation [10]. Orbak *et al.*, reported a higher incidence of gingival inflammation during the eruption of teeth in diabetic children compared to non-diabetic children [7].

Changes in the sequence of eruption are also noted in children with diabetic mellitus. This may lead to malalignment and crowding which in turn leads to difficulty in maintaining good oral hygiene causing gingivitis and periodontitis. Though the exact cause of alteration in eruption sequence is not known, diabetic osteoclastic activity, nourishment and hormonal change in diabetic children might affect the eruption process [11]. Few studies have proved that children with diabetes show accelerated eruption in the early mixed dentition period and delayed eruption when the child is in the late mixed dentition period. Contrary to this one study reports accelerated eruption in the late mixed dentition period. The reasons for this variation need to be explored [7-12].

### **Diabetes Mellitus Effect on Plaque Accumulation, Gingival and Periodontal Health**

The oral cavity shows severe changes like the prevalence of periodontal disease, oral mucosal diseases, dental caries and saliva dysfunction which affects the quality of life of an individual [13]. Salivary dysfunction in diabetic children leads to an increase in dental plaque accumulation due to the maturation of *Streptococcus mutans* and other bacteria hence leading to the acidification of the enamel surface [14]. Hyperglycaemia and glucosuria are the main factors for the decreased flow rate of saliva as they cause a decrease in the secretion of the same [13].

Furthermore, Diabetes mellitus is a predisposing condition for periodontal inflammation. Periodontal problems become a major concern during adolescence as it start at a very early age which is followed by accelerated tooth eruption [7]. Diabetes mellitus brings about other changes such as excessive calculus formation, inflammation, mobility and pocket formation which leads to severe periodontitis [1]. Vascular changes are also seen in DM patients resulting in increased gingival bleeding hence giving a higher gingival index value of the individual as the condition of the gingiva worsens with time and severity of the disease [7].

Microscopically it is seen that blood and body fluids that contain protein have thick and weak blood vessels which are due to excessive production of glycoprotein because of hyperglycemia and hence result in periodontal changes as well as reduced level of polymorph nuclear cells functions such as microbe adherence, chemotaxis, bacterial phagocytosis, cell migration, and oxygen utilization [14]. Additionally, IL-17 is a factor and is also related to many diseases like diabetes, inflammatory bowel disease (IBD), obesity, arthrosis, periodontitis and even cancers. It is seen that loss of periodontal bone is due to IL 17 which is mainly from Th17, which eventually causes bone resorption and osteoclastic activation because of a receptor activator of NF- $\kappa$ B ligand (RANKL). In patients with diabetes mellitus, high serum levels of IL-17 is easily evident. Periodontitis and diabetes mellitus follow a two-way relationship and hence result in the advancement of NF- $\kappa$ B signalling to trigger pro-inflammatory responses and initiation of immunity dysfunction condition. This leads to increased articulation of RANKL, increased osteoclast genesis and high inflammation levels in periodontal tissue, causing severe bone loss [15]. According to the Firatli *et al.*, It is estimated that children and adolescents with diabetes mellitus also show a higher level of clinical attachment loss [16]. It has also been noted that the prevalence of soft tissue lesions like oral ulcers and chelates is higher in children with diabetes mellitus. Increased microorganism infections, poor soft tissue regeneration and neural

sensory disorders are the consequences of T1DM [14].

### Diabetes Mellitus Effect on Dental Caries

As dental caries is a multi-factorial disease hence factors like saliva and dental plaque are one of the major causes for its occurrence [17]. Poor glycaemic control of diabetes mellitus eventually causes drying of the mouth hence increasing the risk of dental caries. Patients with Diabetes Mellitus usually have xerostomia and salivary dysfunction which eventually reduces the salivary flow rate, lowers buffer capacity and causes a higher possibility of dental caries. Bicarbonate, phosphate, and protein buffer systems are the three main buffer systems in saliva that regulate the continuation of salivary pH and in dental remineralization. A study on buffer capacity among diabetic and non-diabetic children done by Saes Busato *et al.*, reported that salivary buffering capacity was moderately decreased after 15 months in pubescence with type 1 diabetes mellitus; at T0, it was 4.8, and at T1, it was 3.9. It is also suggested that hypo salivation and the period of the disorder is related with the depletion of the buffer capacity in T1DM. It was also found that there is high level of Lactobacillus in saliva in children with type 1 diabetes and this is due to poor metabolic control of diabetes [2].

### CONCLUSION

Diabetes mellitus is a causative factor for many oral complications. Diabetes Mellitus is a disease that is increasing in frequency at a very high speed worldwide hence it is important to prevent the consequences as early as possible. For this, the first step is that all diabetic children should make regular visits to the dental clinic and guardians should be counselled about the importance of good oral hygiene. Other further preventive methods are to take complete dental and medical histories, proper dietary evaluations and counselling, topical fluoride application to prevent dental caries progression and instructions for proper oral hygiene. An appreciable amount of metabolic control will reduce the high rate of prevalence of dental caries among diabetic children. It was also seen that the requirement for professional gingival scaling was higher among diabetic children than the normal individuals. Diabetes Mellitus plays a very noteworthy role in oral complications and therefore it becomes important for oral health practitioners to take good care of these children's oral hygiene.

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