**International Journal of Current Advanced Research**
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 9; Issue 06(D); June 2020; Page No.22614-22617
DOI: http://dx.doi.org/10.24327/ijcar.2020.22617.4467

**Research Article**

# REFORMING PEDIATRIC DENTISTRY FOR DIABETIC INFANTS, CHILDREN AND ADOLESCENTS - AN OVERVIEW

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**A R T I C L E I N F O**

***Article History:***
Received 06th March, 2020
Received in revised form 14th April, 2020
Accepted 23rd May, 2020
Published online 28th June, 2020

***Key words:***
Diabetes Mellitus, Hyperglycaemia, Gingivitis, Periodontitis,

**A B S T R A C T**

Dental treatment in case of diabetic children is aimed to be as conservative as possible with a preventive protocol and symptomatic treatment of any oral manifestation of the disease with immediate referral to primary care. The clinician, especially the pediatric dentist needs to have a thorough knowledge of the clinical manifestation and appropriate measures to deal with diabetic children. But there is very little literature that summarizes all of the diabetic findings seen in pediatric dentistry. Therefore this article enumerates the oral and dental findings and their clinical approach for children suffering from diabetes.



## INTRODUCTION

In medical literature there has been enough documentation regarding diabetic children and their management. Even the dental literature is not lagging behind in enumerating the dental findings in an adult patient. For instance, salivary gland dysfunction, burning mouth syndrome, oral lichen planus and candidiasis are found in a diabetic adult patient. But for some unknown reason, dental finding in diabetic children in case of pediatric dentistry have been ignored. Hence this article elaborates on all such findings in children.

### *Overview of Diabetes Mellitus*

Diabetes mellitus (DM) is a group of metabolic diseases which is characterized by hyperglycemia which is due to defects in insulin secretion and/or insulin action. It is generally classified into 4 different categories: Type 1 in which the pancreatic $\beta$ cells lose their insulin producing capacity, often leading to absolute insulin deficiency. Type 2 which is due to a progressive loss of $\beta$ cells. Gestational Diabetes Mellitus which is any degree of glucose intolerance diagnosed in the first or second trimester of pregnancy. Specific type of diabetes due to other causes, for eg Monogenic Diabetic Syndrome, drug or chemical induced diabetes(drugs used for the treatment of HIV or after organ transplant), disease of the exocrine pancreas, such as cystic fibrosis.

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[1]It is imperative to mention that the terms "juvenile-onset diabetes", "non- insulin- dependent diabetes", "insulin-dependent diabetes", "adult-onset diabetes" and acronyms IDDM and NIDDM are now obsolete and no longer used. Usage of the terms "type1 DM" and "type 2 DM" are preferred and also it is preferred that they should be written with Arabic rather than Roman numerals.[2]

### *Type 1 DM*

It comprises of 5-10% of the DM cases. It results from an autoimmune destruction of insulin producing beta cells of the pancreas. Most commonly it occurs in children, one-fourth of the cases are seen in adults. However, it can occur at any age and leads to absolute insulin deficiency. Its incidence depends on various factors family history, age, environmental factors etc. symptoms caused by hyperglycemia includes polydypsia, polyuria and weight loss. Children having type 1 diabetes often show diabetic ketoacidosis with high incidence of severe complications and are also prone to other autoimmune disorders such as Hashimoto's thyroiditis, Grave's disease and Addison's disease.

### *TYPE 2 DM*

It comprises of 90-95% of cases of DM. it begins as insulin resistance, a disorder where cells do not use insulin properly. The pancreas gradually loses its ability to produce insulin, as the need for insulin rises. It is associated with family history, obesity, old age, impaired glucose metabolism, history of gestational diabetes, physical inactivity,and race/ethinicity.

Type 2 diabetes is frequently being diagnosed in children and adolescents. In this prolonged hyperglycemia may result in hyperosmolar non-ketotic acidosis. It usually gets undiagnosed for many years however, the patients are at a higher risk of developing microvascular and macrovascular complications. Its classic symptoms include polyuria, polydypsia, parasthesia, recurrent blurred vision and fatigue. Osmotic dieresis is present late in the disease. It is considered to be a facet of Syndrome X including hyperinsulinemia, dyslipidemia, hyperglycemia and hypertension together knows as Reaven's Syndrome.

***Gestational Dm (GDM)***

It is a form of glucose intolerance which is diagnosed in some women during pregnancy. It is common among women with family history and obese women. It requires treatment to normalize maternal blood glucose levels to avoid complications in infant during pregnancy. Around 5-10% of women with gestational diabetes are found to have type 2 diabetes after pregnancy. Chances of developing diabetes in women who had gestational diabetes in next 5-10 years is 20-50%.

***Other Specific Types***

These are relatively uncommon and result from surgery, specific genetic conditions (maturity- onset diabetes in youth), malnutrition, drugs (glucocorticoids, thiazides), infections and other illness. In people with pre-existing defects in secretion of insulin excess amounts of cortisol, glucagon, epinephrine and growth hormone causes DM. This accounts for 1-5% of all the diagnosed cases of diabetes.

***Oral Health in Children Suffering from Type 1 Dm***

There are a number of studies worldwide that enumerate the relation of type 1 DM with different aspects of oral health.

***Dental Plaque, Calculus, Gingivitis and Periodontitis***

As we are well aware, dental plaque leads to calculus formation which further leads to gingivitis and if still not treated leads to periodontitis. Finally the teeth become mobile and ultimately fall out. Many studies have concluded that the incidence of chronic gingivitis in patients who are suffering from Type I DM is significantly higher than that in healthy population and it increases with age.[3] Also, there are literature stating higher incidence of dental plaque and heavier and early formation of calculus is seen in diabetic children.[4] It has been confirmed that there is about thrice the risk of periodontitis in an individual with diabetes, therefore it is labeled as 'the sixth chronic complication of diabetes'.[5] There is strong evidence that there is association of poorly controlled diabetes and development of periodontitis in children with type I DM.[6]

***Impaired Immune Response in Diabetes and Periodontitis***

DM induced hyperglycemia can have negative effects in the immune system. There is increased concentration of glucose in saliva and GCF leading to increased glucose availability in the oral environment resulting in increased proliferation of cariogenic bacteria and thus in increased oral inflammation. Thus it will further lead to periodontal destruction.[7] Also, DM induced hyperglycemia can lead to microagiopathy. Hyperglycemia also increases advanced glycation end product formation.

***Dental Caries***

Literature regarding dental caries in diabetic children is quite dicey. Dental caries being a multifactorial disease some factors increase the risk of dental caries while some seem to reduce it. Studies have established that in diabetic children the levels of cariogenic bacteria, particularly of *Streptococcus mutans*, are higher.[8] As per the nutritional recommendations, the quantity of extrinsic sugar which are artificially added to food should ideally be low while the intrinsic sugar which are present in fruits and vegetables can be moderately consumed in diabetic children. However, the frequency of the meals should be higher compared to healthy individuals.[9] There have been studies in which it has been extensively prove that there is lower prevalence of dental caries in the deciduous teeth of diabetic children.[10]

***Candidias is***

Oral candidiasis is an opportunistic fungal infection which is commonly associated with hyperglycaemia. Hence it is a frequent complication of uncontrolled or marginally controlled diabetes.

***Saliva***

There is reduced salivary flow, especially unstimulated saliva in diabetic children. No significant difference is observed in stimulated salivary flow. There are reports of both lower calcium levels11 and higher calcium levels12 in the saliva of diabetic children.

***Diet***

There are a set of dietary rules for diabetic children. There should be restricted intake of fat and sometimes even proteins but the carbohydrate intake should be 50 – 60 % of the daily calorie intake. The carbohydrate intake should consist primarily of complex carbohydrate where as simple carbohydrates should be avoided as it results in postprandial hyperglycemia. However the standard recommendation for diabetic children is 6 meals per day.[13]

***Pathophysiology of DM[14]***

Blood glucose levels are usually maintained within a range of 60-50 milligrams per deciliter, or in mg/Dl throughout the day in healthy people. Insulin regulates the blood glucose levels. It is synthesized by the beta cells of pancreas and is rapidly secreted into the bloodstream in response to elevated blood sugar after meals. Insulin maintains glucose homeostasis by facilitating uptake of glucose from the blood into cells by its storage as glycogen in the liver. It also promotes uptake of amino acids and fatty acids with subsequent conversion to triglycerides and protein stores. Insulin resistance or lack of insulin leads to inability of insulin dependent cells to use blood glucose as energy source. Breaking down of stored triglycerides into fatty acids serves as an alternate source of fuel and results in elevation in blood ketone levels leading to diabetic ketoacidosis. Glucose is excreted in urine resulting in excessive urination (polyuria) due to elevated blood glucose levels or hyperglycemia as a consequence of osmotic dieresis. Excessive fluid loss causes dehydration and increased thirst (polydipsia). As cells are starved of glucose, it leads to increased hunger (polyphagia) due to which cells are unable to take up glucose and the diabetic patient frequently loses weight.

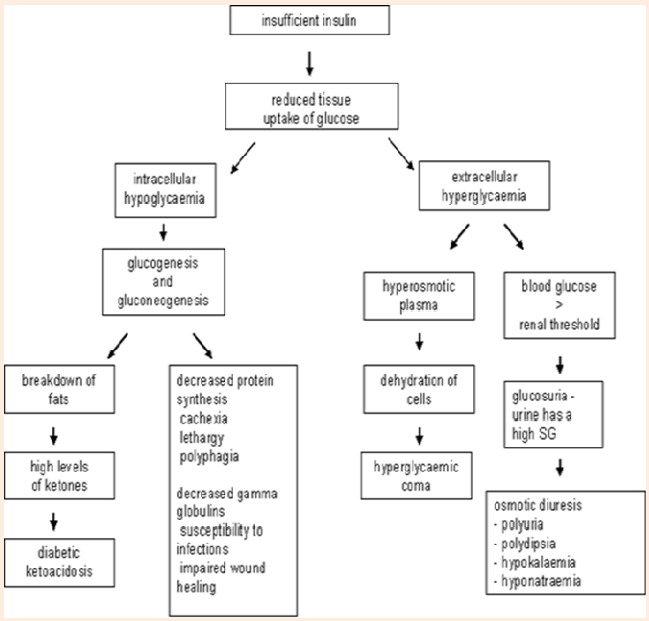


**Figure 1:**

### *Stages of Type I Dm*

Skyler JS *et al*[15] enumerated the stages of diabetes and the diagnostic tool and method for each stage.

| Stages | Phenotypical characteristic | Diagnosis |
|---|---|---|
| Stage 1 | • Normoglycemia<br>• Autoimmunity<br>• Presymptomatic | • No impaired glucose tolerance<br>• Multiple autoantibiotics<br>• Fasting plasma glucose 100–125 mg/dL<br>• HbA1c 5.7–6.4% or ≥ 10% increase in HbA1c |
| Stage 2 | • Dysglycemia<br>• Autoimmunity<br>• Presymptomatic | • 2-h glasma glucose 140–199 mg/dL<br>• Multiple autoantibodies<br>• Dysglycemia is defined as impaired glucose tolerance and/or impaired fasting glucose |
| Stage 3 | • Hyperglycemia<br>• New onset<br>• Symptomatic | • Clinical symptoms<br>• Diabetes by standard criteria |

### *Criteria for Diagnosis of Diabetes*[1]

Diagnosis of diabetes may be based on Plasma Glucose (PG) criteria or A1C criteria, either the fasting plasma glucose (FPG) or 2-h plasma glucose (2-h PG) value following a 75-g oral glucose tolerance test (OGTT).

| Test | Maximum level |
|---|---|
| Hb A1C (to be performed in a lab via a NGSP certified and DCCT standardized protocol)* | ≥ 6.5% |
| FPG ( No calorie intake for a minimum of 8 hrs) | ≥ 126 mg/dl |
| 2-h PG | ≥ 200 mg/dl |
| Random Glucose Test | ≥ 200 mg/dl |

*NGSP: National Glycohemoglobin Standardization Program;
*DCCT: Diabetes Control and Cornplications Trial
≤ 110 mg/dl is considered as normal fasting plasma glucose level.

### *Considerations in the Dental Clinic*

It is an understood fact that proper case history of the child should be taken when he/she turns up for a treatment in the dental clinic. Sometimes the patient or his parents report a history of diabetes for which the dentist should be prepared and should have a thorough knowledge of the clinical signs and symptoms and should be aware of his next step of treatment plan. Hence we are enumerating the significant features of a diabetic patient and the medical and dental approach towards the patient by the dentist.

### *Clinical manifestation of untreated diabetes*

- ✓ Excessive thirst (Polydipsia)
- ✓ Frequent urination (Polyurea)
- ✓ Elevated blood glucose level (Hyperglycemia)
- ✓ Fatigue
- ✓ Loss of weight
- ✓ Retarded growth in infants

### *Oral manifestation of untreated diabetes*

- ✓ Increased susceptibility to dental caries
- ✓ Accelerated tooth eruption with increase in age
- ✓ Xerostomia (dry mouth) due to salivary gland dysfunction
- ✓ Taste dysfunction
- ✓ Oral candidiasis
- ✓ Impaired or delayed wound healing
- ✓ Gingivitis with higher risk of periodontal disease

### *Other concerns*

- ✓ Ketoacidosis, kidney failure, gastroparesis, diabetic neuropathy and retinopathy
- ✓ Poor circulation, increased occurrence of infections, and coronary heart disease

### *General management*

- ✓ Proper case history
- ✓ Assessment of glycemic control
- ✓ Ask the patient to consult a physician if signs and symptoms are evident.
- ✓ Use of a glucometer in the dental clinic is advised to avert diabetes related emergencies.
- ✓ Frequency of recall and follow up visits if the patient should be increased.
- ✓ Smoking and tobacco cessation programs should be encouraged.

### *Dental management*

- ✓ Short appointments mostly at mornings.
- ✓ It is to be ensured that the child has taken his/her meal and his/her medication prior to the treatment.
- ✓ Oral disease progression, oral hygiene, diet, and smoking habits to be monitored frequently.
- ✓ Periodontal diseases need to be treated aggressively as it can worsen diabetes and associated cardiac disease.
- ✓ Child's physician needs to be consulted before surgical procedures as insulin dosage may need to be adjusted.
- ✓ In children with candidiasis, sugar-free Nystatin can be prescribed. Clotrimazole is to be avoided as it raises blood glucose level.

- ✓ Management with topical and systemic medications is indicated to decrease frequency and duration of infection for children with recurrent HSV infection. Increased oral comfort will aid in improving childs ability to manage diabetes through diet.
- ✓ For children with poorly controlled diabetes, antibiotic coverage is to be prescribed as there may be increased risk of infections and delayed wound healing.
- ✓ Ulcerations and oral infections need to be treated aggressively.
- ✓ Diabetic children and adolescents who smoke are many times more probable to develop periodontitis
- ✓ In some cases there may be a hypoglycemic episode of the child during the dental treatment. The symptoms manifested are hunger, mood changes, weakness and decreased spontaneity leading to sweating, tachycardia and incoherence. In such case, dental treatment should be terminated immediately and 10 – 15 gms of fast acting carbohydrate, in the form of juices or sugar is to be administered. Blood glucose level is to be monitored to assess whether additional carbohydrate is to be administered or not.

## CONCLUSION

The dentist plays a pivotal role in maintaining the child's glycemic control by educating the child and the parents about proper oral hygiene and a proper diet and also by treating oral infections and periodontal problems of the patient. Not just a pediatric dentist but also a general dentist should be well prepared for these kind of patients in the dental clinic and deal with the emergencies and act accordingly. Sometimes it can happen that the child comes to the dental clinic himself / herself not being aware of that he/she may be diabetic but the general and clinical symptoms might manifest so. Even in such case the dentist plays a major role in timely recognizing the symptoms and referring to an appropriate physician.

## References


1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes care. 2014 Jan 1;37(Supplement 1):S81-90.
2. Lalla RV, D'AMBROSIO JA. Dental management considerations for the patient with diabetes mellitus. *The Journal of the American Dental Association.* 2001 Oct 1;132(10):1425-32.
3. Salvi GE, Franco LM, Braun TM, Lee A, Rutger Persson G, Lang NP, Giannobile WV. Pro-inflammatory biomarkers during experimental gingivitis in patients with type 1 diabetes mellitus: a proof-of-concept study. *Journal of clinical periodontology*. 2010 Jan;37 (1):9-16.
4. Lalla E, Cheng B, Lal S, Tucker S, Greenberg E, Goland R, Lamster IB. Periodontal changes in children and adolescents with diabetes: a case-control study. Diabetes care. 2006 Feb 1;29(2):295-9.
5. Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, Taylor R. Periodontitis and diabetes: a two-way relationship. Diabetologia. 2012 Jan 1;55(1):21-31.
6. Novotna M, Podzimek S, Broukal Z, Lencova E, Duskova J. Periodontal diseases and dental caries in children with type 1 diabetes mellitus. Mediators of inflammation. 2015;2015.
7. Ryan ME, Carnu O, Kamer A. The influence of diabetes on the periodontal tissues. *The Journal of the American Dental Association*. 2003 Oct 1;134:34S-40S.
8. Cameron AC, Widmer RP. Handbook of pediatric dentistry. Mosby.
9. Mehta SN, Volkening LK, Quinn N, Laffel LM. Intensively managed young children with type 1 diabetes consume high-fat, low-fiber diets similar to age-matched controls. Nutrition research. 2014 May 1;34(5):428-35.
10. Lal S, Cheng B, Kaplan S, Softness B, Greenberg E, Goland RS, Lalla E, Lamster IB. Accelerated tooth eruption in children with diabetes mellitus. Pediatrics. 2008 May 1;121 (5):e1139-43.
11. López ME, Colloca ME, Páez RG, Schallmach JN, Koss MA, Chervonagura A. Salivary characteristics of diabetic children. *Brazilian dental journal*. 2003 Jun;14(1):26-31.
12. Moreira AR, Passos IA, Sampaio FC, Soares MS, Oliveira RJ. Flow rate, pH and calcium concentration of saliva of children and adolescents with type 1 diabetes mellitus. *Brazilian Journal of Medical and Biological Research*. 2009 Aug;42(8):707-11.
13. Gardner DG. Endocrine emergencies: myxedema coma. Greenspan's Basic Clinical Endocrinology. 2007:868-70.
14. Nirmala SV, Saikrishna D. Dental care and treatment of children with diabetes mellitus: An overview. J Pediatr Neonatal Care. 2016 Feb;4(2):1-4.
15. Skyler JS, Bakris GL, Bonifacio E, Darsow T, Eckel RH, Groop L, Groop PH, Handelsman Y, Insel RA, Mathieu C, McElvaine AT. Differentiation of diabetes by pathophysiology, natural history, and prognosis. Diabetes. 2017 Feb 1;66(2):241-55.


**How to cite this article:**

Dr. Mylavarapu Krishna Sagar, Dr. Priyanka Tiwari and Dr. Suyog Jain (2020) 'Reforming Pediatric Dentistry for Diabetic Infants, Children and Adolescents - an Overview', *International Journal of Current Advanced Research,* 09(06), pp. 22614-22617. DOI: http://dx.doi.org/10.24327/ijcar.2020. 22617.4467

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