THE HIDDEN FACES OF DIABETES AND THE DENTAL IMPLICATIONS

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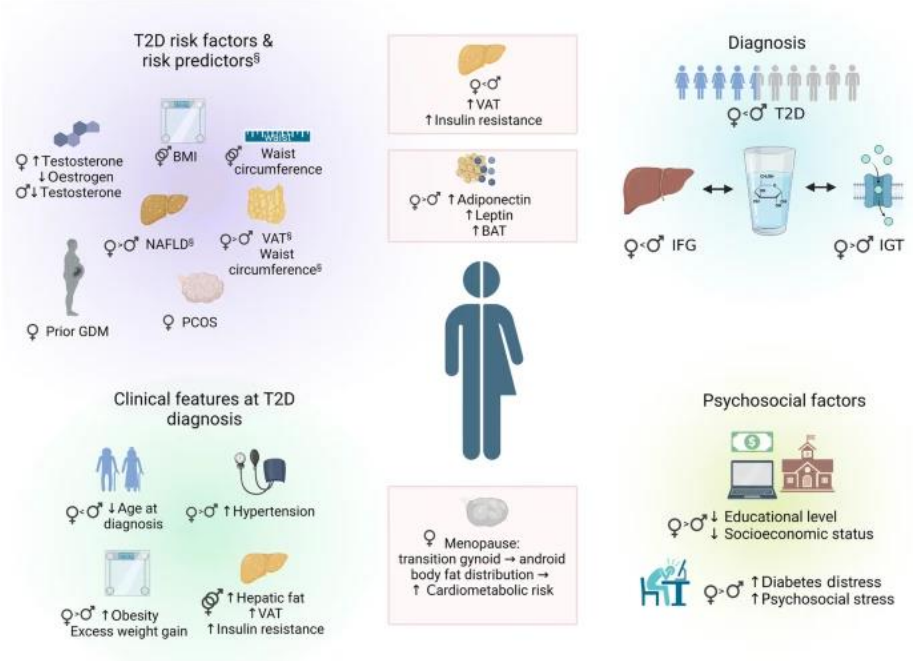
The ancient Greek Apollonius of Memphis was the first to use the term "diabetes" between 250 and 300 B.C. The term "diabetes" in Greek means "siphon or pass," and the word mellitus refers to "sweet" in reference to the sweet urine of those affected.[1]

Type 1 diabetes, also known as insulin-dependent diabetes mellitus (IDDM), is an autoimmune disease that results from the elimination of insulin-producing pancreatic beta cells. Type 1 diabetes produces up to a 40% risk of all-cause mortality in women compared to men and doubles the risk of fatal and nonfatal vascular events in men.[2] Type 1 diabetes, which develops in childhood, represents a loss of 17.7 years of life in women compared to 14.2 years of life lost in men.[2]

Type 2 diabetes, also known as non-insulin-dependent diabetes mellitus (NIDDM), is a condition in which insulin is not used optimally or insulin production is restricted. Ethnicity plays a role in its prevalence, where African Americans, Hispanics, Native Americans, Asians, and Pacific Islander Asians are more susceptible.[3] Being over 45 increases your risk, as well as being overweight during pregnancy, a condition known as gestational diabetes.[3] Men tend to develop type 2 diabetes at a younger age with a lower body mass index (BMI). At the same time, women demonstrate higher blood pressure and more significant weight gains later in life compared to their male counterparts.[4]



Source: 4 Diabetologia Mar 2023

Type 1.5 diabetes is also called latent autoimmune diabetes in adults (LADA). It is a slowly progressive variant of type 1 diabetes; a normal BMI is usually present, which affects adult patients over 30-35 years of age and is insulin-dependent during the first six months of the condition.[5]

Source Instagram: Recently, Lance Bass (@lancebass), member of NSYNC, shared he was "misdiagnosed with Type 2 Diabetes" when, in fact, he had "Type 1.5m also known as LADA, or latent autoimmune diabetes in adults."

Type 3 diabetes appears to be the presentation in which the brain resists insulin. This process seems to be associated with Alzheimer's disease, where the inability to perform basic tasks and perform learning and memory functions is present.[6]

Type 3c diabetes, due to trauma from a disease such as pancreatitis or cystic fibrosis or from physical trauma such as a car accident, the pancreas becomes unable to function properly.[6] Physical organ damage can manifest in a reduction or complete loss of enzyme production, where enzymes involved in digestion are affected, a condition known as exocrine pancreatic insufficiency (EPI). In addition, there are often effects on endocrine function, which involves hormonal dysfunction of insulin and glucagon, two vital hormones that control blood sugar in the bloodstream.[7]

Hypoglycemia, hyperglycemia, and diabetic ketoacidosis may manifest in the presentation of the alterations.

Hypoglycemia: A condition in which blood glucose levels drop below average. For many people with diabetes, this means a blood glucose level of 70 milligrams/deciliter (mg/dL) or less. Although patients with diabetes often recognize the signs and symptoms of hypoglycemia and self-intervene before changes or loss of consciousness occur, staff must be trained to recognize the signs and treat patients accordingly.[8]

Hyperglycemia occurs when blood glucose levels are abnormally high. This can happen whenever there is not enough insulin in your bloodstream, or your body is not using insulin properly.[8]

Diabetic ketoacidosis: Diabetic ketoacidosis is a serious condition that can develop when there is not enough insulin to help the body effectively use glucose.[8]

Symptoms and Treatment for Patients with Diabetes Mellitus		
Hypoglycemia	**Hyperglycemia**	**Diabetic Ketoacidosis**
Mild to Moderate Symptoms		
Shakiness	High levels of sugar in the urine	Fruity smelling breath
Sleepiness	Frequent urination	Very dry mouth
Sweating	Increased thirst	High blood glucose levels
Blurred vision	Fatigue	Abdominal pain
Fast or irregular heartbeat	Blurred vision	Frequent urination
Loss of coordination		Shortness of breath
Dizziness or lightheadedness		Constant tired feeling
Headaches		Dry or flushed skin
Trouble concentrating, confusion		High levels of ketones in the urine

Symptoms and Treatment for Patients with Diabetes Mellitus		
Hypoglycemia	**Hyperglycemia**	**Diabetic Ketoacidosis**
Mild to Moderate Symptoms		
Change in behavior or personality		Difficulty concentrating or confusion
Nervousness		Nausea or vomiting
Hunger		
Weakness		
Irritability		
Argumentative, combative		
Paleness		
Tingling/numbness of the lips or tongue		

Source 8: University of Oklahoma School of Health Sciences Dentistry Handbook 2023-2024

Severe Symptoms		
Unable to eat or drink		
Seizures or convulsions		
Unconsciousness		

Source 8: University of Oklahoma School of Health Sciences Dentistry Handbook 2023-2024

Treatment		
1. Provide the patient with 15-20 grams of oral carbohydrates to eat or drink	1. Lifestyle changes, like increased exercise or eating a healthy, well-proportioned diet	1. If ketoacidosis is suspected, the symptomatic person should be taken to the nearest emergency room
2. Wait 15 minutes, then check blood glucose levels again.	2. If ketones are present in urine, the patient should not exercise and should consult their physician	2. Patient's physician should be immediately contacted
3. Repeat these steps until blood glucose levels are above 70 mg/dL.		
In severe cases, If the dental patient is not awake and/or unable to eat or drink, emergency medical help should be summoned.		

Source 8: University of Oklahoma School of Health Sciences Dentistry Handbook 2023-2024

Carbohydrate Options:	½ cup regular (non-diet) soda
4 glucose tablets or one tube of glucose gel	½ cup of fruit juice*
1 tablespoon of sugar, honey or corn syrup	8 ounces of non-fat or 1% milk
Hard candies, jelly beans or gumdrops	2 tablespoons of raisins

*NOTE: People who have concomitant kidney disease should not drink orange juice for their 15 grams of carbohydrates because of the high potassium content. Apple, grape, or cranberry juice cocktail are good alternatives.

Source 8: University of Oklahoma School of Health Sciences Dentistry Handbook 2023-2024

HbA1C and Estimated Average Glucose (eAG)

(28.7 x A1C) – 46.7 = eAG mg/dl

HbA1c (%)	**eAG mg/dl**	**Treatment Considerations**
4	≤70	Provide the patient with 15-20 grams of oral carbohydrates to eat or drink.
5	97	**No contraindications to dental treatment.**
6	126	
7	154	
8	183	Proceed with dental treatment but monitor glucose levels if any symptoms arise.
9	212	
10	240	Delay dental treatment until diabetes is considered stable.

A dental provider may want to ask a patient with diabetes questions such as:

- How old were you when you were diagnosed with diabetes, and what type of diabetes do you have?
- What medications do you take?
- How do you control your blood sugar levels?
- How often do you see your doctor about your diabetes? When was your last doctor's visit?
- What was your most recent HbA1c (A1C) result?
- Have you ever had episodes of exceptionally low (hypoglycemia) or extremely high blood sugar (hyperglycemia)?
- Have you ever felt disoriented, agitated, and anxious for no apparent reason?
- Do you have sores or discomfort in your mouth?
- Does your mouth feel dry?
- Do you currently use high-end weight management medications (GLP-1)?
- Do you have any other medical conditions related to your diabetes, such as heart disease, high blood pressure, a history of stroke, eye problems, numbness in the extremities, kidney problems, delays in wound healing, or a history of gum disease? Please describe it.

Clinical manifestations of untreated diabetes

- High blood glucose
- Excessive thirst
- Frequent urination
- Weight loss
- Fatigue
- 5P's (polyphagia, polyuria, polydipsia, polyneuropathy, and pruritus)

Oral

- Increased risk of tooth decay due to salivary hypofunction
- Tooth eruption accelerated with growing age.
- Gingivitis with an elevated risk of periodontal disease (poor control increases risk)
- Salivary gland dysfunction leading to xerostomia.
- Deterioration or delayed wound healing.
- Taste dysfunction
- Oral Candidiasis
- Higher incidence of lichen planus

Other possible disorders/concerns

- Ketoacidosis, kidney failure, gastroparesis, diabetic neuropathy and retinopathy, poor circulation, increased incidence of infections and coronary heart disease.

Blue tooth insulin pump: Courtesy Dr. Tyrone Rodriguez

Blue tooth live-time glucose meter for precision monitoring, highly effective during stressful dental procedures. Courtesy: Dr. Tyrone Rodriguez

Dental Treatment and Prevention

- Ensure glycemic control at the time of the appointment. Review recent diabetes control with the patient; hemoglobin Alc (HbA1c) <7 indicates reasonable control in the previous three months, and >8 indicates poor control.
- Ask the patient for medication updates at each appointment. Changes in medication can affect proper patient care from a medical and/or appointment management standpoint.
- Have a source of glucose available in the office.

- Schedule short appointments in the morning. Ensure the patient has eaten and taken the usual medication before treatment.
- Monitor vital signs at appointments. Approach patients with abnormal heart rate and/or elevated blood pressure cautiously. Poor physical condition generally increases the risk of complications during and after dental treatment.
- Monitor the progression of oral disease, oral hygiene, diet, and frequent smoking habits. Consider increasing the frequency of periodontal recall and maintenance. Treat periodontal disease aggressively. Periodontal disease can significantly worsen diabetes and associated heart disease.
- Consult with the patient's physician prior to surgical procedures, as insulin dose adjustment and postoperative diet modification may be necessary.
- Sugar-free nystatin (clotrimazole troches usually contain sugar and should be avoided) should be prescribed in patients with candidiasis.[9]

Patients who are carriers of Herpes type viruses such as HSV-2 and CMV were 59% and 33% more likely to develop prediabetes or diabetes than individuals not previously infected, respectively.10 For the Herpes Simplex Virus, infection treatment with systemic and topical medications is indicated to decrease the frequency and duration of infection. Increased oral comfort will improve the patient's ability to manage diabetes.

1. Consider antibiotic coverage for invasive dental procedures for those with poorly controlled diabetes, as there may be an increased risk of infection and delayed wound healing. It is recommended to consult with the patient's treating physician. Treat oral infection (such as recurrent HSV) and ulceration aggressively, as increased oral comfort will improve the patient's ability to manage their diabetes through diet.
2. Provide education for smoking prevention and cessation. People with diabetes who smoke are 20 times more likely to develop periodontitis.

Hypoglycemic episodes:

Symptoms include mood swings, hunger, weakness, and decreased spontaneity, leading to tachycardia, sweating, and incoherence. If it occurs, finish dental treatment immediately and administer 15 grams of fast-acting carbohydrates (1/2 can of regular soda, 4 ounces of fruit juice, or 3-4 glucose tablets). Check your blood glucose after treatment to determine if extra carbohydrates are needed. If the patient is unable to swallow or loses consciousness, seek medical assistance, and administer 1 mg glucagon IM or subcutaneously.[9]

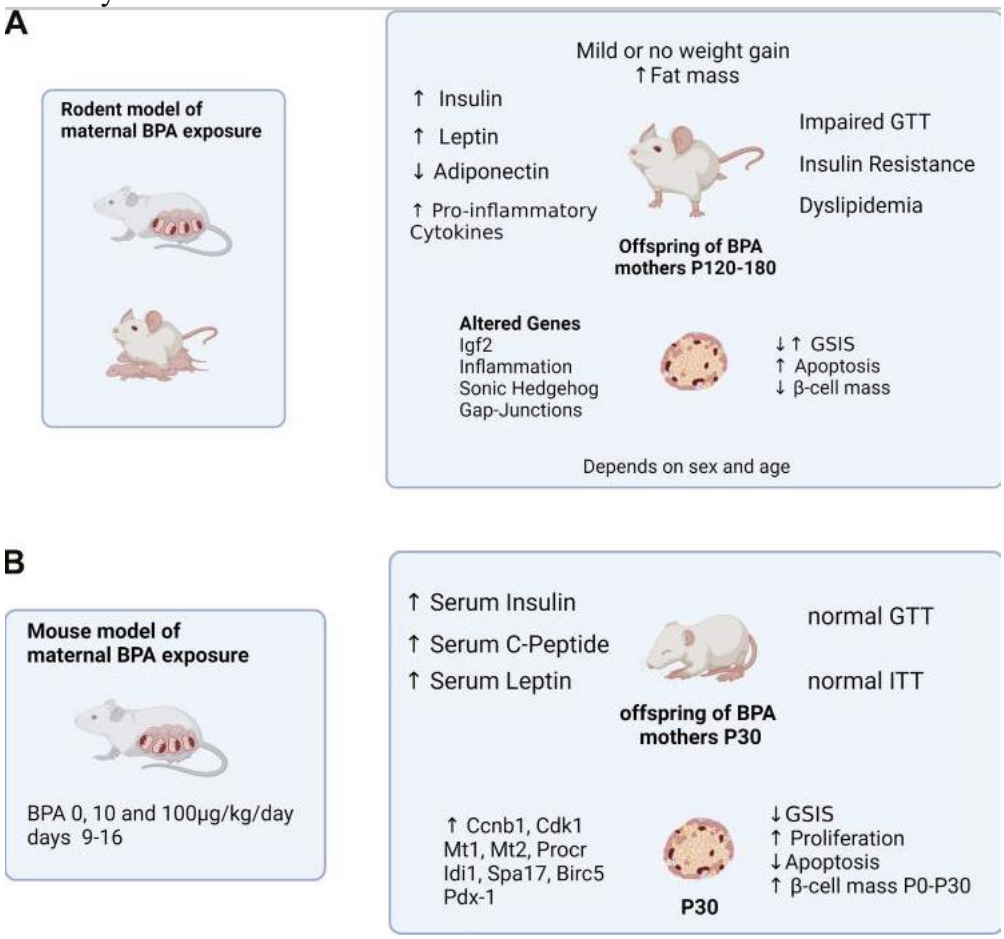
As needed for patients with xerostomia:

1. Educate on proper oral hygiene (brushing, flossing) and nutrition.
2. It is recommended that you brush your teeth with a toothpaste that contains fluoride before going to bed. After brushing, apply 1.1% neutral fluoride gel (e.g., Gel Prevident 5000) on trays or with a brush for 2 minutes. Instruct the patient to spit out excess gel and NOT rinse with water, eat, or drink before bedtime.

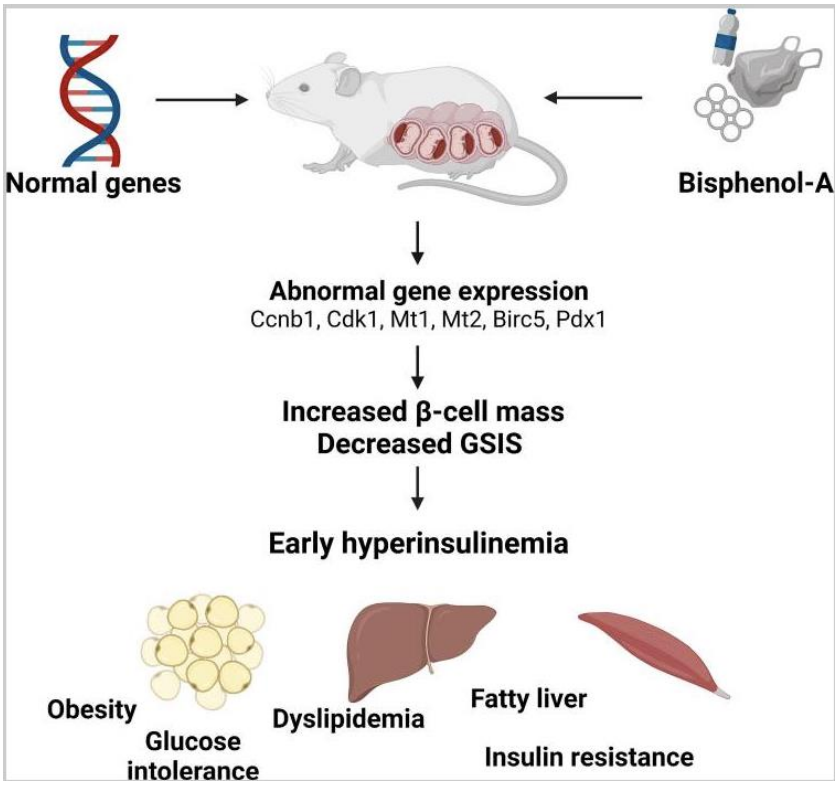
Recommend mints, lozenges, and/or gum with xylitol to stimulate saliva production and resistance to decay.[9]

In conclusion:

The many faces of diabetic presentations should encourage us to dig deeper upon just accepting the traditional IDDM and NIDDM diagnoses. A better understanding of sugar management's role in oral health combined with systemic health should drive today's oral health providers to be more inquisitive when provided with this finding in our patient history taking. We have not seen the full manifestation of this condition as more factors are playing roles in contributing to an increased prevalence. An increase of roughly 60% has been reported by the NIH in Type-2 diabetes after COVID-19 infection compared to people not previously infected.[11] Additionally, endocrine disruptors such as bisphenols, phthalates, and Per-and polyfluorinated alkyl substances (PFAS) found in our environment and products, of which dental materials/packaging contribute to, are linked to Beta-cell dysfunction in the pancreas. Alarmingly, the below graphics show generational changes caused by these chemicals.[12]



Source 12: American Journal of Physiology: Endocrinology Metabolism, May 3, 2023.



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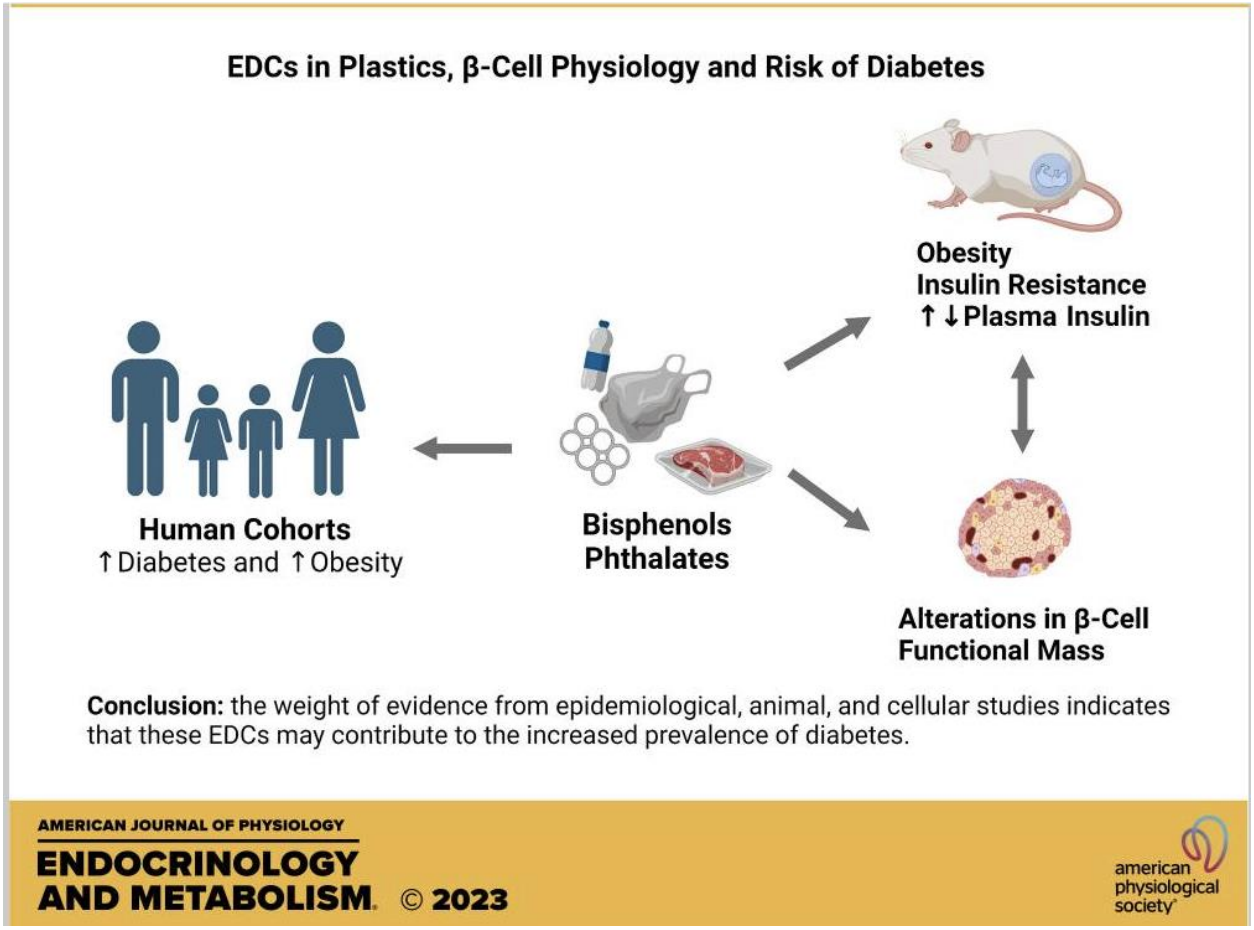

Source 12: American Journal of Physiology: Endocrinology Metabolism, May 3, 2023.

The collective awareness that we have to treat and prevent the incidence of diabetes is a monumental task for present and future dental professionals. The urgency is now in making generational and transcending professional practice and education changes. The dental profession must relentlessly advocate for mandatory organic foods that are minimally processed. The dental profession must promote movement. Sedentary living is the new smoking as far as poor long-term health. Lifestyle activity modification begins in childhood, such as bringing back long recess at school. Finally, the keystone to mitigation practices is elevating social understanding and appreciation that oral health is integral to systemic health and quality of life.

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