

DIABETES AND ORAL HEALTH: The not-so-sweet relationship

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Diabetes mellitus (DM) is characterized as a group of diseases that develops when the body is unable to produce any or enough insulin, or is incapable of effectively utilizing insulin to synthesize glucose needed for cellular energy, resulting in abnormally high blood sugar (glucose) levels.¹

The most common types of diabetes are type 1 diabetes, type 2 diabetes, and gestational diabetes.² Disturbingly, some studies report that type 2 diabetes is likely to be the biggest epidemic in human history because of the rise in numbers and the global burden of the disease.³

Studies indicate a connection between poorly controlled blood sugar and Alzheimer's disease.⁴ Because of the strength of this relationship, some have coined Alzheimer's "diabetes of the brain" or type 3 diabetes, which corresponds to a chronic insulin resistance plus insulin deficiency state that is largely confined to the brain.^{4,5}

Recent studies in metabolic research indicate the emergence of an underrecognized form of diabetes termed type 4 diabetes, which is linked to lean, elderly individuals with insulin resistance.⁶ Another underestimated type of diabetes, type 3c diabetes, occurs when the pancreas stops producing enough insulin for the body as a result of pancreatic disease.⁷

Less common forms of diabetes include monogenic diabetes syndrome, cystic fibrosis-related diabetes, and drug- or chemical-induced diabetes.² Other forms of dysglycemia can develop including prediabetes, impaired glucose tolerance, and impaired fasting glucose.

Although each of the types of diabetes share a common problem—elevated blood glucose levels—the cause, who is affected, how a person is affected, and clinical management look different. Another commonality among the various types of diabetes is the oral implications, which we will discuss later.

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Prevalence of diabetes

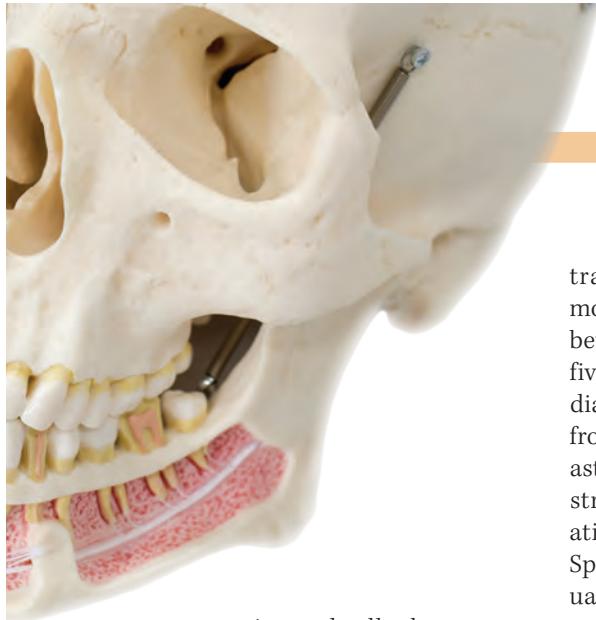
Diabetes is a common disease that is increasing in incidence worldwide, with greater increases in middle- and low-income countries.⁸ The number of individuals with diabetes rose from 108 million in 1980 to 476 million in 2017, accounting for 8.5% of the adult population 18 years and older.⁸

The Centers for Disease Control and Prevention (CDC) reports that nearly 35 million American adults have diabetes, while one in five Americans with diabetes remains undiagnosed.⁹ Forty-three percent of deaths related to elevated glucose levels occurred in people younger than 70, and in 2019, an estimated 1.5 million deaths worldwide were directly caused by diabetes.¹⁰ Diabetes is the leading cause of adult blindness, kidney failure, and lower limb replacements, and between 2000 and 2016, premature mortality from diabetes rose by more than 5%.⁸ Diabetes is projected to be the seventh leading cause of death worldwide by 2030.⁸

Diabetic complications

Left uncontrolled, elevated levels of blood glucose are sustained in the body and lead to diabetic complications resulting from nonenzymatic binding of free sugars in the body to





proteins and cells that cause a reduced efficacy in their functioning.¹¹

Diabetic complications are classified as microvascular diseases and macrovascular diseases.¹² Microvascular diseases cause damage to small blood vessels, while macrovascular diseases cause damage to major arteries.¹² Within these two main classifications, diabetic complications are generally associated with five categories: neuropathy, cardiovascular disease, altered wound healing, retinopathy, and nephropathy.

Oral implications of diabetes

The biological relationship between DM and periodontal diseases has been well documented in the literature since the 1960s.¹³ In the 1990s, after 90 published epidemiological studies and exhaustive research, the bidirectional relationship between diabetes and periodontal disease was well established, and periodontitis became known as the sixth complication of diabetes.¹³

In addition to periodontal disease, an increase in the incidence of caries can be seen in diabetic patients. Hyperglycemia leads to reduced salivary flow, thus facilitating the growth of aciduric bacteria counts such as *Streptococcus mutans*, resulting in carious lesion development.¹⁴ In fact, people with a longer disease duration are at a higher risk for developing caries.¹⁵

As the medical community embraces the potential for periodontal therapy to result in therapeutically meaningful reductions in markers of systemic inflammation, and dentistry

transitions to a whole-body health model, it is important to screen for diabetes in the dental setting since one in five patients with type 2 diabetes is undiagnosed⁹ and the oral complications from diabetes can have long-term, devastating effects on hard and soft tissue structures in the mouth.¹⁶ The Association of Diabetes Care and Education Specialists recommends that individuals diagnosed with DM get a dental exam and monitor dental health, paving the way for the dental team to be a part of the collaborative care required for disease management.¹⁷

When providing oral care for diabetic patients, the clinician must ensure that ample time is devoted to oral health education. During this educational session, the clinician should highlight the importance of meticulous

inflammatory cytokine expression.¹⁸ Xylitol also helps to neutralize the pH in the mouth, creating a more favorable environment to commensal bacteria.

Hydroxyapatite is the main component of enamel, primarily composed of calcium and phosphate.¹⁹ Nano-hydroxyapatite has significant remineralizing effects on initial enamel lesions, more so than conventional fluoride, because of its ability to fill the tiniest surface lesions in the tooth substance.^{19,20} This action not only prevents the development of dentinal hypersensitivity but also smooths the tooth surface, making it difficult for pathogenic bacteria to settle on the tooth surface.²⁰

Fluoride helps to harden enamel and convert hydroxyapatite to fluorapatite, which is less soluble in an acidic

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lous home care to control biofilm levels in the oral cavity, which have been associated with the initiation and disease progression of both periodontal and caries disease, along with a discussion on other oral side effects of the disease including dry mouth from medication.

It is imperative to arm patients with at-home treatment therapies that offer preventive benefits, promote oral health, and help manage dental conditions resulting from diabetes.

Remineralizing enamel

Among ingredients beneficial to patients with diabetes, three compounds stand out: xylitol, sodium fluoride, and nano-hydroxyapatite.

Xylitol is known to have cariostatic properties and may have a good clinical effect for periodontitis by its inhibitory effect on the LPS-induced

environment as compared to its counterpart, thereby offering greater protection for the tooth surface.

Remin Pro is a unique tooth cream formulated with xylitol, sodium fluoride, and nano-hydroxyapatite. It is designed to contribute to the neutralization of acids caused by plaque biofilm. Remin Pro contains 1,450 ppm fluoride, more than traditional oral pastes and creams. Remin Pro is great tasting and can also be used after conservative dental treatment, professional tooth cleaning and whitening, or with orthodontic treatments.²⁰ It works with the oral environment in the mouth to modify biofilm and add hydroxyapatite to the existing teeth, aiding in remineralization, making it an ideal product for protective tooth care for diabetic patients.

Remin Pro should not be used like traditional toothpastes. Patients can apply a pea-sized amount to their

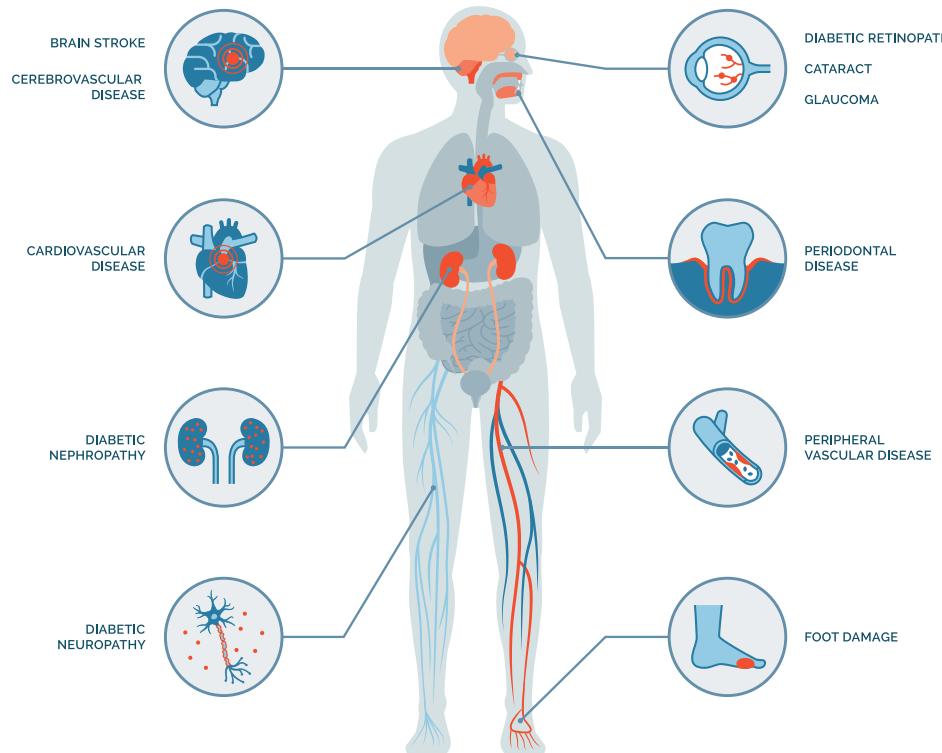
Major complications of diabetes mellitus

CHRONIC COMPLICATIONS

- Retinopathy
- Foot problems
- Heart attack
- Stroke
- Nephropathy
- Neuropathy
- Gum disease
- Periodontitis
- Cancer
- Sexual dysfunction

ACUTE COMPLICATIONS

- Hypoglycemia
- Hyperglycemia
- Hyperosmolar hyperglycemic state
- Diabetic ketoacidosis



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teeth with a finger, toothbrush, or cotton swab and distribute it throughout their mouth with their tongue. Ideally, the patient should keep both the Remin Pro and saliva in their mouth for three minutes before expectorating and wait at least 30 minutes after use before eating or drinking.

As the number of patients with diabetes coming in for oral care continues to climb, dental professionals will need to remain vigilant in their understanding of the distinct types of diabetes along with systemic and oral complications. They should also be able to provide ideal treatment solutions that promote oral health. **RDH**

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