Dental considerations for the treatment of patients with diabetes mellitus

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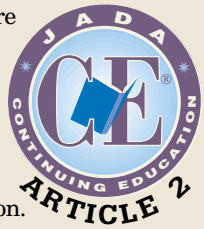
ABSTRACT

Background. Dentists play a major role as part of an allied health team in providing oral care to patients with diabetes. As such, they may detect undiagnosed cases of diabetes and refer patients to physicians for further evaluation.



Methods. The author describes new concepts in metabolic control for diabetes and the relationship of oral complications to diabetes mellitus. The treatment of acute oral infections and the dentist's role in supporting patients in smoking-cessation programs are approaches that may reduce morbidity from diabetes mellitus. In consultation with the patient's physician, the dentist may need to modify the treatment plan where systemic complications are present.

Results. Working with the physician, nutritionist and dental hygienist, the dentist can maintain the patient's oral health and possibly improve the patient's metabolic control of diabetes. In consultation with the patient's physician, the dentist can discuss the indications and contraindications of medications for the treatment of oral complications in patients with systemic complications resulting from diabetes. Using a glucometer may avert emergencies related to diabetes.

Conclusions. The dental team can improve the metabolic control of a patient's diabetes by maintaining optimal oral health. The dentist also can reduce comorbidity factors by supporting patients in tobacco-use cessation programs.

Clinical Implications. Dentists can reduce the morbidity and mortality associated with diabetes by maintaining their patients' oral health and by referring patients with signs and symptoms of oral complications suggestive of diabetes to physicians for further evaluation.

Diabetes mellitus is a complex and pernicious syndrome. It is characterized by abnormalities in carbohydrate, lipid and protein metabolism that result either from a profound or an absolute deficiency of insulin, related to autoimmune destruction of the insulin-producing pancreatic beta cells (type 1, or insulin-dependent diabetes mellitus), or from target-tissue resistance to its cellular metabolic effects, related commonly to obesity (type 2, or non–insulin-dependent diabetes mellitus). Type 1 diabetes represents no more than 5 percent of primary diabetes cases, whereas type 2 represents the remainder of the primary cases.[1]

There is no definitive cure for diabetes. It is the most common endocrine disorder and affects an estimated 16 million people in the United States. An additional estimated 6 million people have diabetes but do not know it. Without a proper diagnosis, these people are at significant risk of developing life-threatening complications.[2] These include increased susceptibility to infection and delayed healing; neuropathy, retinopathy and nephropathy (microvascular disease); accelerated atherosclerosis with associated myocardial infarction and coronary artery disease; stroke; atherosclerotic aneurysms (macrovascular disease); and amputation. Hyperglycemia (elevated blood glucose) is a hallmark of diabetes mellitus—as are its chronic metabolic complications. These are generally more severe in the patient with type 1 diabetes mellitus.

Dentists can reduce the morbidity and mortality associated with diabetes by maintaining their patients' oral health.

GLYCEMIC CONTROL REVISITED

Blood glucose or glycemic control is fundamental to the medical management of diabetes; prolonged and severe hyperglycemia is associated with systemic and oral complications. Thus, a management plan is needed. This plan should be formulated as an individualized therapeutic alliance among the patient and family, the physician and other members of the health care team,

including the family dentist and dental hygienist, and the nutritionist. In developing the plan, the team should consider several patient aspects:

- age;
- school or work schedule and conditions;
- physical activity;
- medications (insulin or oral hypoglycemic agents);
- diet and eating patterns;
- social situation and personality;
- cultural factors;
- the presence of complications (systemic and/or oral) of diabetes;
- any other medical conditions.

The glycosylated hemoglobin, or HbA_{1c}, test is used widely to assess glycemic control over a three- to four-month period. Prospective randomized clinical trials have shown that achieving glycemic control, through percentage reductions in the HbA_{1c}, is associated with decreased rates of microvascular disease. Furthermore, epidemiologic studies support the potential of intensive glycemic control in the reduction of macrovascular disease.[3-7]

The goal of medical management is to target HbA_{1c} values to less than 7.0 percent, or less than 150 milligrams/deciliter of blood glucose on average, every three to six months; if greater than 8.0 percent, then action is recommended. However, it has been shown that other features of glucose control not reflected in the HbA_{1c} might add to or modify the risk of complications. For example, recent clinical data demonstrate that the risk and severity of complications may be even more highly dependent on the extent of one- to two-hour postprandial (after meal) hyperglycemic spikes of blood glucose.[8,9] Acute hyperglycemia after meals is associated with increased free-radical production that can lead to tissue toxicity and damage, and, ultimately, may be associated with renal failure. Acute hyperglycemic spikes (or excursions) after a two-hour postload are associated with an increased risk of death, independent of fasting blood glucose. The risk of microvascular disease increases with the progression in postprandial glucose levels from 180 to 260 mg/dL.[10] Thus, tight control in current medical therapy now includes a shift to a new focus: constant, daily self-monitoring of blood glucose with a glucometer, four to six times per day, and often before and after meals to target postprandial levels and to minimize the occurrence of acute hyperglycemia and acute tissue toxicity.

Glucometers are relatively inexpensive and provide a rapid (five- to 30-second) and accurate determination of blood glucose in a small volume (1 microliter) of blood obtained with a sterile lancet from the fingertip. Except possibly for the patient who has the classic symptoms of diabetes, with glucose and acetone in the urine, most physicians depend on blood chemistry values, not only to establish the diagnosis of diabetes but also to manage it. Furthermore, monitoring glucose in urine is no longer a current practice among patients with diabetes; this is because cases have been reported with blood glucose levels of 300 to 400 mg/dL without any evidence of urinary glucose.[1] However, patients may test urine for acetone (that is, ketones) with diagnostic test strips during periods when metabolic control is not attained.

Walking a "metabolic tightrope" of rigorous control involves risk: patients with diabetes, particularly those with type 1 diabetes who use multiple daily insulin injections or an insulin pump, may fall into profound hypoglycemia or low blood sugar (insulin shock), which may lead to life-threatening diabetic ketoacidosis.

ORAL COMPLICATIONS OF DIABETES

The oral complications of uncontrolled diabetes mellitus are devastating. These may include, but are not necessarily limited to, gingivitis and periodontal disease; xerostomia and salivary gland dysfunction; increased susceptibility to bacterial, viral and fungal (that is, oral candidiasis) infections; caries; periapical abscesses; loss of teeth; impaired ability to wear dental prostheses (related in part to salivary dysfunction); taste impairment; lichen planus; and burning mouth syndrome.[11]

Gingivitis and periodontal disease. The susceptibility to periodontal disease—often called the "sixth complication of diabetes mellitus"[12]—is the most common oral complication of diabetes. The patient with poorly controlled diabetes is at greater risk of developing periodontal disease. It starts with gingivitis and then, with poor glycemic control, progresses to advanced periodontal disease. Children with diabetes and adults with less-than-optimal metabolic control show a tendency toward higher gingivitis scores.[13-15] In one study, the prevalence of periodontal disease was 9.8 percent in 263 patients with type 1 diabetes, compared with 1.7 percent in people without diabetes.[16] Several studies have

demonstrated that patients with type 1 diabetes and chronic, marginal metabolic control of the disease have more extensive and severe periodontal disease than do patients who maintain rigorous control of their diabetes. Patients with type 1 diabetes and retinopathy tend to exhibit more loss of periodontal attachment by the fourth and fifth decades of life.[17] Thus, good oral hygiene and frequent checkups with the dentist are extremely important for the patient with type 1 diabetes.

Fewer studies have been conducted on patients with type 2 diabetes and periodontal disease. It has been shown that patients with type 2 diabetes are three times more likely to develop periodontal disease than are people without diabetes.[18] In a study of Pima Indians (40 percent of whom have type 2 diabetes), people younger than 40 years of age had increased attachment loss compared with Pima Indians who did not have diabetes, as well as alveolar bone loss that was associated with increased glucose intolerance or poor metabolic control.[19] In this same study, periodontal tissue destruction increased with age and was higher in people with diabetes compared with people without the disease in all age groups.[19] The loss of teeth was also 15 times higher in Pima Indians with diabetes than in Pima Indians without diabetes.[19]

Other studies have assessed tooth loss and edentulism in people with type 1 diabetes.[20] When people with diabetes smoke, they are 20 times more likely to develop periodontitis with loss of supporting bone than are those without diabetes.[18]

Although primarily related to the presence of dental plaque, periodontitis appears to be related to several pathological events associated with diabetes,[21] but the reason for the higher rates of periodontal destruction in people with diabetes is not completely understood. Studies have shown that the microorganisms in the periodontal flora are similar in people with diabetes and in those without diabetes. This suggests that differences in the host response to periodontal pathogens are related to the increased tissue destruction in diabetes.[22,23] The pathological events in diabetes may also include impairment in cell-mediated immunity such as neutrophil (polymorphonuclear leukocyte, or PMN) chemotaxis and macrophage function[24,25] and vascular disease. There is also evidence that a history of chronic periodontal disease can disrupt control of diabetes, suggesting that periodontal infections may have systemic repercussions.[26]

Whereas the exact nature of this complex relationship is not yet clear, it has been shown that dental infections in patients with diabetes may exacerbate problems with metabolic control. Furthermore, there is evidence that the management of periodontal infections in the poorly controlled patient with diabetes may actually help improve glycemic control.[27] A careful evaluation of glycemic control, including the patient's diet, HbA_{1c} and postprandial glucose determinations, is critical in determining the risk assessment for progression to the oral complications, especially periodontitis, of diabetes.

Several studies have demonstrated that patients with type 1 diabetes and chronic, marginal metabolic control of the disease have more extensive and severe periodontal disease than do patients who maintain rigorous control of their diabetes.

The oral complications in patients with uncontrolled diabetes are most likely related to the altered response to infection, microvascular changes and, possibly, increased glucose concentrations in the saliva (salivary hyperglycemia) and gingival crevicular fluid. Salivary hyperglycemia may be an important contributory factor to periodontal disease.[28] Increased salivary glucose results in additional bacterial substrate and plaque formation.[29] Increased gingival crevicular fluid glucose may diminish the ability of periodontal fibroblasts to contribute to periodontal healing.[30] Thus, preventive periodontal therapy must be included in the comprehensive care of the patient with diabetes. Therapy includes an initial assessment of the risk of oral disease progression, explicit oral hygiene instruction, dietary assessment and instruction, and frequent periodic dental examinations and prophylaxis.

Salivary gland dysfunction and xerostomia. There are reports of dry mouth complaints (xerostomia) and salivary hypofunction in patients with diabetes,[31-33] which may be due to polyuria, or an underlying metabolic or endocrine problem. When the normal environment of the oral cavity is altered because of a decrease in salivary flow or alteration in salivary composition, a

healthy mouth can become susceptible to dental caries and tooth deterioration. Dry, atrophic and cracking oral mucosa is the eventual complication from insufficient salivary production. Accompanying mucositis, ulcers and desquamation, as well as an inflamed, depapillated tongue, are also common problems. Difficulty in lubricating, masticating, tasting and swallowing are among the most devastating complications from salivary dysfunction and may contribute to impaired nutritional intake.

An increase in the rate of dental caries has been reported in young patients with diabetes and may relate to salivary dysfunction.[34] One study showed that patients with diabetes did not have a higher coronal or root-surface caries rate than patients without diabetes, independent of glycemic control.[35] Nonetheless, an association existed between older adults with diabetes and active caries and tooth loss; this was even more significant in patients with diabetes having poor glycemic control.[35] The dentist can offer topical treatments such as fluoride-containing mouthrinses and salivary substitutes to help prevent caries and minimize discomfort.

Improvement in glycemic control has a major role in reducing the occurrence of complications such as xerostomia and candidiasis.

Candidiasis. Oral candidiasis is an opportunistic fungal infection commonly associated with hyperglycemia and is thus a frequent complication of marginally controlled or uncontrolled diabetes.[36, 37] Oral lesions associated with candidiasis include median rhomboid glossitis (central papillary atrophy), atrophic glossitis, denture stomatitis, pseudomembraneous candidiasis (thrush) and angular cheilitis. *Candida albicans* is a constituent of the normal oral microflora that rarely colonizes and infects the oral mucosa without predisposing factors. These include immunologically compromised conditions (for example, AIDS, cancer or diabetes), the wearing of dentures in conjunction with poor oral hygiene and the long-term use of broad-spectrum antibiotics. Salivary dysfunction, compromised immune function and salivary hyperglycemia that provides a potential substrate for fungal growth are the major contributing factors for oral candidiasis in patients with diabetes.

Burning mouth syndrome. Patients with burning mouth or burning tongue syndrome usually exhibit no clinically detectable lesions, although the symptoms of pain and burning can be intense. The etiology of burning mouth is varied and often difficult to decipher clinically.[38] The symptoms of pain and burning appear to be the result of one factor, or possibly a combination of factors.[39] In uncontrolled or marginally controlled diabetes, these etiologic factors can include salivary dysfunction, candidiasis and neurological abnormalities such as depression. Autonomic and sensory-motor neuropathies are part of the diabetes syndrome, and the prevalence of neuropathy in diabetes mellitus approximates 50 percent 25 years after the onset of the disease, with an overall 30 percent rate among adults with diabetes.[40] Neuropathy may lead to oral symptoms of paresthesias and tingling, numbness, burning or pain caused by pathological changes involving the nerves in the oral region.[1] Diabetes has been associated with oral burning symptoms[39,41]; however, neuropathy from diabetes is typically associated with pain and burning in other parts of the body, such as the feet.[40]

Of particular significance is the finding that symptoms of burning mouth or tongue have been found in undiagnosed cases of type 2 diabetes, most of which also resolved after medical diagnosis and subsequent treatment directed at improving glycemic control.[42] Improvement in glycemic control has a major role in reducing the occurrence of complications such as xerostomia and candidiasis, and these factors may contribute more significantly to the resolution of the symptoms associated with burning mouth syndrome in the patient with diabetes.

Lichen planus. Lichen planus is a relatively common, chronic mucocutaneous disease of unknown cause. It generally is considered to be an immunologically mediated process that involves a hypersensitivity reaction on the microscopic level.[39] It is characterized by an intense T lymphocytic infiltrate ($CD4^+$ and especially $CD8^+$ cells) located at the epithelial–connective tissue interface. Other immune-regulating cells (for example, macrophages, dendritic cells, Langerhans' cells) are seen in increased numbers in lesions of lichen planus. There appears to be no relationship between lichen planus and either hypertension or diabetes mellitus (that is, Grinspan's syndrome), as previously proposed.[39]

However, a study of 40 patients with lichen planus found that 11 patients (28 percent) had overt or latent diabetes, compared with none in the control group, implying that diabetes may be related to the immunopathogenesis of lichen planus.[43]

Acute oral infections. Representative examples of acute oral infections—such as recurrent bouts of herpes simplex virus, a periodontal abscess or a palatal ulcer—illustrate the severity of these conditions, particularly in marginally controlled diabetes. Case reports have been published on a life-threatening deep neck infection from a periodontal abscess[44] and on fatal palatal ulcers in patients with diabetes.[45] In the latter, the ulcers were not superficial, but represented deep granulomatous disease. To what extent such incidents are part of the broader spectrum of infection in people with diabetes has not yet been established. It is possible that the same pathogenic mechanisms associated with the increased susceptibility to periodontal infections (for example, impaired wound healing, diminished chemotaxis and PMN function) may play a role in the greater likelihood of developing acute oral infections.

Glycemic control in diabetes management is the key to reducing the impact of acute oral infections.

GENERAL MANAGEMENT CONSIDERATIONS

The dentist plays a major role in referral of patients with diabetes to physicians for additional evaluation.[1] Any undiagnosed dental patient who has the cardinal signs and symptoms of diabetes (that is, polydipsia, polyuria, polyphagia, weight loss, weakness), or who presents with an oral manifestation (for example, xerostomia or candidiasis), should be referred to a physician for diagnosis and treatment.

With a glucometer, a dentist can test blood glucose from a patient's fingertip. If the result is consistent with hyperglycemia, then immediate follow-up with a physician is indicated. Even if the patient were to have a normal glucose level with such testing, immediate follow-up with a physician would still be indicated, particularly if the patient had the above signs or symptoms or oral manifestations suggestive of uncontrolled, undiagnosed diabetes.

If the physician to whom a dentist has referred a patient subsequently diagnoses the patient with diabetes mellitus, then the patient may be spared from life-threatening complications. However, an important caveat must be mentioned here: the glucometer is not accepted as a diagnostic device and the dentist is not qualified medicolegally to make a diagnosis.

All patients with diagnosed diabetes must be identified by history. A thorough understanding of their medical treatment—including medications, regimen and the degree of glycemic control, as well as any systemic complications resulting from diabetes—then must be methodically established. In the case of systemic complications from diabetes mellitus (for example, hypertension, cardiovascular disease, retinopathy, renal insufficiency or failure), the dentist must consult with the patient's physician to discuss any modifications to the dental treatment plan, particularly when surgical procedures are anticipated.

For example, in the patient with cardiovascular disease, monitoring blood pressure is extremely important, as is the possible modification of anticoagulant drugs (for example, aspirin) before and after surgery. A current recommendation in medical therapy is the use of aspirin (75-325 mg/day) in all adult patients with diabetes and macrovascular disease.[46] The avoidance of nephrotoxic drugs in dental management (for example, acetaminophen in high doses, acyclovir, aspirin, nonsteroidal anti-inflammatory drugs) is recommended in patients with renal disease, as well as obtaining a complete blood cell count, monitoring the blood pressure at every appointment, assessing the risk of endarteritis (renal dialysis shunt) or endocarditis, and managing the patient receiving dialysis who is on heparin therapy.[1]

With respect to surgical procedures, the dentist should also test the patient's blood sugar with a glucometer to avert emergency-related events such as insulin shock (profound hypoglycemia) or ketoacidosis with severe hyperglycemia before, during or after an invasive procedure. Any patient with diabetes who is going to receive extensive periodontal or oral surgery procedures other than single, simple extractions should be given dietary instructions after surgery; these instructions should be established in concert with the patient's physician and nutritionist. It is important that the total caloric content and the protein-carbohydrate:fat ratio of the diet remain the same so that proper glycemic control of the diabetes is maintained. The patient's physician should be consulted about dietary recommenda-

tions and dosage modifications to medications during the postoperative phase of dental treatment. In the case of an acute oral infection, not only may antibiotics be indicated—particularly in poorly controlled diabetes—but also modifications in the patient's medications may be needed (for example, increasing the insulin dose to prevent hyperglycemia related to the pain and stress from infection).

Typically, patients also should receive short morning appointments to reduce stress. The release of endogenous epinephrine from stress can have a counter-regulatory effect on the action of insulin, thereby markedly stimulating the breakdown of glycogen in muscle (and to a lesser extent in liver) and leading to hyperglycemia.[47] In the adult patient with diabetes and no history of hypertension, or in the adult patient with diabetes who has well-controlled hypertension, epinephrine can be administered in the usual ranges.[1] Importantly, the inclusion of epinephrine is advisable because it will promote better dental anesthesia and thus may significantly reduce the release of far greater amounts of endogenous epinephrine in response to pain and stress.

Finally, the dentist must play a major role in modifying a patient's destructive health habits, especially those that introduce a comorbidity factor. For example, a large body of evidence from epidemiologic, case-controlled and cohort studies provides convincing documentation of the causal link between cigarette smoking and health risks such as diabetes[48] and oral cancer.[49,50] Much of the research documenting the impact of smoking on health did not discuss separately results on subsets of individuals with diabetes, suggesting the identified risks are at least equivalent to those found in the general population.

Other studies of people with diabetes consistently found a heightened risk of morbidity and premature death associated with the development of macrovascular disease complications among smokers.[48] Smoking also is related to the premature development of microvascular complications of diabetes and may play a part in the development of type 2 diabetes.[48] Large, randomized clinical trials have demonstrated the efficacy and cost-effectiveness of counseling in changing smoking behavior. Such studies, combined with the others specific to people with diabetes, suggest that smoking-cessation counseling is effective in reducing tobacco use.[51,52] A summary of important general management considerations for the patient with diabetes is shown in the box.

BOX

SUMMARY OF GENERAL MANAGEMENT CONSIDERATIONS FOR THE PATIENT WITH DIABETES.

- Assess glycemic control
- Refer patients with signs and symptoms suggestive of undiagnosed diabetes to a physician for diagnosis and treatment
- Obtain a consultation with the patient's physician if systemic complications are present and/or assess the use of medications to treat oral complications
- Use a glucometer to avert emergencies related to diabetes
- Aggressively treat acute oral infections
- Schedule patients for frequent recall visits to monitor and treat oral complications and maintain optimal oral hygiene and diet
- Support and follow up patients in smoking-cessation programs

MANAGEMENT OF THE ORAL COMPLICATIONS OF DIABETES

Risk of disease progression. The comprehensive management of oral infections in patients with diabetes is beyond the scope of this article. Other sources are available that provide advice and examples of detailed therapeutic regimens.[1,53] Nevertheless, clinical recommendations on the treatment of some common oral manifestations of diabetes are provided below.

In general, adults with well-controlled type 1 or type 2 diabetes may have no more significant risk of experiencing oral disease progression than do those without diabetes, and, hence, can be treated similarly. For example, a coronal carious lesion that has not yet penetrated dentin in a patient with well-controlled diabetes may require no immediate intervention, whereas a similar lesion in a poorly controlled patient (moderate to severe hyperglycemia) may need immediate operative treatment, given its higher risk of progression. In general, the risk of progression of oral complications is related to glycemic control and is assessed in part by the interpretation of HbA_{1c} values and postprandial blood sugar levels.

Treatment regimens for candidiasis. Given the centrality of candidiasis as a marker of

TABLE 1

TREATMENT FOR ORAL CANDIDIASIS.*

AGENT	DURATION	LABEL
Topical		
Clotrimazole troches†	Two weeks	Slowly dissolve a 1- to 10-milligram troche in mouth five times/day
Nystatin vaginal suppositories‡	Two weeks	Slowly dissolve one tablet (100,000 units) in mouth six to eight times/day
Systemic		
Fluconazole	Two weeks	100 mg/day
Ketoconazole§	Two weeks	200 mg/day
Itraconazole¶	Two weeks	200 mg/day

* Source: The Dental Standards of Care Committee, New York State Department of Health.[54]
† Use with caution because of sugar content.
‡ Although this preparation is not designed for oral use, clinicians have found it useful for the treatment of oral candidiasis when the sugar content of other topical anticandidal medications is of concern. A sugarless, flavored lozenge may be dissolved simultaneously in the mouth to mask the taste of nystatin.
§ Must use with caution; monitor for hepatotoxicity with liver function tests.
¶ Should be used for resistant strains of *Candida albicans.*

marginally or uncontrolled diabetes, and its secondary relationship to salivary dysfunction, some representative topical and systemic medications for the treatment of oral candidiasis are shown in Tables 1 and 2. It generally is advised that the dentist first assess the sugar content in some of the antifungal preparations before prescribing them. For example, clotrimazole troches should be avoided as these have a relatively high sugar content that may warrant against their use in patients with diabetes (see Table 1 for treatment guidelines[54]). Some representative topical medications, such as creams, for the treatment of angular cheilitis are shown in Table 2. Some of these combination creams contain corticosteroids that provide an anti-inflammatory and antipruritic effect to aid healing; however, steroids can have an antagonistic or counterregulatory effect on the action of insulin and, thus, have the potential to cause hyperglycemia. Nonetheless, it is unlikely that such combination creams will cause a significant elevation of blood glucose, particularly if these are applied to a relatively small area of angular cheilitis.

Management of salivary gland dysfunction and xerostomia. The rationale for the treatment of xerostomia is to provide salivary stimulation or replacement therapy to keep the mouth moist, prevent caries and candidal infection, and provide palliative relief. The management approach for dry mouth can include the use of saliva substitutes and stimulants; this approach may minimize progression of, or prevent the development of, dental caries.[55]

Management of recurrent HSV infections. For the patient with diabetes and recurrent orofacial HSV infection, treatment should be initiated as early as possible in the prodromal stage to reduce the duration and symptoms of the lesion. Oral acyclovir, prophylactically and therapeutically, may be considered when frequent recurrent herpetic episodes interfere with daily function and nutrition. In the patient with diabetes and renal insufficiency or renal failure, acyclovir should be avoided because of its potential for nephrotoxicity.[1]

Management of burning mouth syndrome. For the adult patient with burning mouth syndrome, multiple factors may interact synergistically. In uncontrolled diabetes, xerostomia and candidiasis can contribute to the symptoms associated with burning mouth. In addition to the treatment of these conditions, an improvement in glycemic control is essential to mitigate the symptoms. Given in low dosages, benzodiazepines, tricyclic antidepressants and anticonvulsants can be helpful in reducing or eliminating the symptoms after several weeks or months.[1,38] The dosage of these drugs is adjusted to the patient's symptoms. A potential side effect includes xerostomia. Consultation with the patient's physician is necessary because of the potential of these drugs for addic-

TABLE 2

TOPICAL MEDICATION FOR ANGULAR CHEILITIS.*

AGENT	DURATION	LABEL
Antifungal cream (clotrimazole 1%, miconazole 2%, ketoconazole 2%)	Two weeks	Apply to affected area four times/day
Combination creams† (hydrocortisone-iodoquinol cream, betamethasone dipropionate–clotrimazole cream, triamcinolone-nystatin cream)	Two weeks	Apply to affected area three times/day

* Source: The Dental Standards of Care Committee, New York State Department of Health.[54]
† Some clinicians have found combination creams to be more effective than antifungal medications alone in the treatment of angular cheilitis. These include combination preparations of topical hydrocortisone, antifungal agents and hydrocortisone-iodoquinol cream, which combines an antifungal-antibacterial agent with an anti-inflammatory antipruritic.

tion and dependence. Commonly used medications include amitriptyline, nortriptyline, clonazepam and gabapentin.[1,38] Interestingly, amitriptyline has also been used to treat autonomic neuropathy in diabetes.[40]

Surgical considerations and periodontal management. The dentist can perform periodontal surgical procedures, although it is important for the patient to maintain a normal diet during the postsurgical phase to avoid hypoglycemia (low blood sugar and insulin shock) and ensure effective repair. The dental practitioner must review any previous history of complications, assess the patient's glycemic control and maintain an ongoing dialogue with the patient's physician and nutritionist. The longer the duration of the diabetes, the greater the likelihood of the patient's developing severe periodontal disease.

Supportive periodontal therapy should be provided at relatively close intervals (two to three months). Periodontal infections may complicate the severity of diabetes mellitus and the degree of metabolic control.[26] The adult patient with well-controlled diabetes generally does not require antibiotics following surgical procedures. However, the administration of antibiotics during the postsurgical phase is appropriate, particularly if there is significant infection, pain and stress. The selection of antibiotics is predicated on multiple factors (for example, sensitivity and specificity results, spread of infection), and should be conducted in consultation with the patient's physician.

The mainstay of periodontal therapy for patients with diabetes is nonsurgical, given that surgical procedures may necessitate modification of the patient's medications before and after treatment, and also may lead to a prolonged healing phase owing to diabetes. The combination of nonsurgical débridement and tetracycline antibiotic therapy in patients with diabetes mellitus who have advanced periodontitis may have a potential positive influence on glycemic control. The use of tetracycline in the treatment of periodontal disease was associated with an improvement in glycemic control as assessed by HbA_{1c} assays.[26]

Several published papers have reported an additional therapeutic benefit from tetracyclines in periodontal therapy, principally as inhibitors of the connective tissue–degrading enzymes, the human matrix metalloproteinases. For example, low-dose doxycycline has been shown to inhibit human gingival crevicular fluid collagenase at doses that are not antimicrobial, significantly eliminating the risk of bacterial resistance. Tetracyclines can thus function as inhibitors of bone resorption or bone loss, and this property is independent of their antimicrobial use, providing an added dimension to the therapeutic management of periodontitis.[56-59]

Oral disease management with corticosteroids. Therapies with corticosteroids and immunomodulating drugs have the potential for side effects. Therefore, close collaboration with the patient's physician is needed. The use of steroids in the treatment of erosive lichen planus in the adult patient with diabetes is of considerable concern because steroids can antagonize the action of insulin and lead to hyperglycemia. The patient should be given instructions to self-monitor blood glucose levels frequently during steroid therapy. Prolonged use of topical steroids (for a period of greater than two weeks continuously) may result in mucosal atrophy and secondary candidiasis[1]—conditions that also commonly occur in uncontrolled diabetes. Once the erosive oral lichen planus has resolved, topical steroids should be tapered to alternate-day or

less-frequent therapy, depending on the control of the erosions and the tendency toward recurrence. Emerging nonsteroidal immunomodulator drugs (for example, tacrolimus ointment, topical thalidomide) may be useful in the medical management of the patient with concomitant oral mucosal disease and uncontrolled diabetes.

CONCLUSION

The dentist plays a major role with allied members of the health team in helping a patient maintain glycemic control by properly treating oral infections, and by instructing the patient with diabetes to maintain rigorous oral hygiene and a proper diet.

The dentist also can play a vital role in referring patients with signs and symptoms suggestive of undiagnosed diabetes to a physician for additional evaluation.

Finally, as an integral member of the health care team, the dentist can counsel patients with diabetes to stop smoking—a risk factor that may exacerbate some of the vascular complications associated with diabetes.

The patient with diabetes who is receiving good medical care and who maintains rigorous glycemic control generally can receive any indicated dental treatment. The adult with well-controlled diabetes who is without systemic complications should be treated similarly to a patient without diabetes—namely, antibiotics must not be prescribed unless they are absolutely necessary (for example, an acute oral infection).

The patient with systemic complications resulting from diabetes may require modification of the dental treatment plan following a consultation with the patient's physician. ■

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