

Medications: Impact on Dental Diagnosis and Treatment Planning

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Medications are risk factors for both periodontal disease and caries. The risk factors for medications affect how researchers design their studies, how pharmaceutical manufacturers develop the products they make, and how practitioners design their patients' treatment plans.

Practitioners must consider how medications can affect plaque composition, gingival tissue, alveolar bone, gingival crevicular fluid, salivary flow, and a patient's oral hygiene procedures. It is estimated that by the year 2010, at least 20% of the population will be over the age of 65. Oral complications will become more

Abstract

Today, many patients regularly take prescription and over-the-counter medications, yet they do not realize that these medications are a risk factor for periodontal disease and caries. Sugar is a major component in many medications, which presents a serious caries challenge. In some cases, this sugar challenge is compounded by an acidic pH. Attitude-altering medications may make it difficult to motivate a patient to comply with oral hygiene procedures. Other medications can cause severe gingival enlargement, affect the gingival crevicular fluid, or alter other host factors. Many medications cause xerostomia, which can lead to problems such as root surface caries and candidiasis. In many cases, these drugs cannot be substituted and dosages cannot be reduced, so it is essential to detect adverse conditions early and begin oral hygiene treatment planning to prevent more severe dental conditions from developing. This article discusses the impact of medications on treatment planning for patients who have clinical manifestations of dental problems that are attributed to medications.

Learning Objectives

After reading this article, the reader should be able to:

- discuss the effect of attitude-altering medications on oral hygiene.
- describe the harmful effects of medications that alter plaque composition and pH.
- list examples of medications that can cause xerostomia and other problems in the oral cavity.
- explain the treatments for patients with medication-induced oral complications.

prevalent in the future as this aging population inevitably increases the number of medications taken regularly.

Medical curriculums teach little about teeth, periodontal disease, caries, or oral health. These topics are left mainly to the dentist and dental curriculums. Pharmaceutical companies have traditionally not considered dental decay and caries when devel-

oping medications, and few, if any, of these companies involve dentists in product development. The American Dental Association is now addressing these issues, so they will hopefully be corrected in the future. Until physicians, pharmacists, and pharmaceutical manufacturers become more familiar with the oral health problems associated with medication use, dental professionals must be aware of the

medications that their patients take and must assume a greater responsibility for their long-term effects on the oral cavity.

Attitude-Altering Medications

Oral hygiene has a very low priority for patients compared with other health problems, such as psychological or cardiovascular problems, for which they are receiving medications. These medications may make a patient care less about performing oral hygiene. Attitude-altering medications compromise the manner and frequency with which patients use toothbrushes, toothpaste, mouth rinses, and other oral hygiene products. They also make it more difficult to motivate patients by giving them a "care less" attitude about daily activities, including performing adequate oral hygiene.

Two of the more popular antidepressant drugs, Xanax^{®a} (alprazolam) and Prozac^{®b} (fluoxetine), make patients feel better about themselves. However, they also make it more difficult to motivate patients to perform adequate oral hygiene (Table 1). In addition, drugs that are used to treat hypertension lower blood pressure, but they are also slightly depressive, which can affect the patient's attitude toward oral hygiene and make motivation more difficult. Commonly used hypertension medications include Vasotec^{®c} (enalapril) and Capoten^{®d} (captopril).¹

Patients who take these attitude-altering medications may need more frequent dental recall visits. They also may need adjunctive oral hygiene products that help make home oral hygiene easier and more effective.

Medications That Alter Plaque Composition and pH

Many medications alter plaque composition and pH in ways that are harmful to the oral cavity. Sugar is a major component in antacid tablets, many liquid preparations, cough drops, and chewable tablets, including vitamins.² Many of these liquid and chewable products are taken by children, making them very susceptible to caries.³

Medications That Create a Sugar Challenge

Over-the-counter (OTC) medications and liquid preparations are used daily by some patients. These readily fermentable carbohydrates in thick liquid preparations, lozenges, and troches may significantly alter the plaque pH, cause root surface caries in older patients, and may have an effect on the metabolism of periodontal pathogens.

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Advertisements state that Tums^{®e} is the most-often used agent for preventing osteoporosis. Although the calcium in this antacid may be effective in preventing osteoporosis, the second

Table 1—"Attitude-Altering" Medications

Antidepressant type of medications such as sedatives, tranquilizers, narcotic analgesics, antimetabolites, and antihypertensives, including:

- alprazolam (Xanax^{®a})
- fluoxetine (Prozac^{®b})
- enalapril (Vasotec^{®c})
- captopril (Capoten^{®d})

highest concentrated ingredient listed in this antacid tablet is sugar. Therefore, this medication can help prevent one illness (osteoporosis), while encouraging another (caries).

An example of the sugar challenge presented by antacids involved a patient on a 3-month dental recall who always had either a new or recurrent caries lesion at each visit. For 18 months, dentists tried to treat her caries problem with every possible solution, including topical fluorides, sealants, at-home fluoride, in-office fluorides, and dietary modification, but nothing helped. Finally, at one visit, the clinic receptionist discovered that the patient used about three rolls of antacid tablets each day for her frequently upset stomach. The sugar in these antacids was responsible for her caries. This is a prime example of why it is essential that the dental staff is aware of all medications that patients take regularly, even OTC products that patients might think are harmless.

It was recently reported that a dental hygienist noticed that patients taking antifungal medications had very high caries rates.⁴ It turns out that every available antifungal medication, with the exception of rectal suppositories, has sugar as its highest concentration ingredient. So, the hygienist

^a Pharmacia & Upjohn Co, Kalamazoo, MI 49001

^b Dista Products & Eli Lilly and Co, Indianapolis, IN 46285

^c Merck and Co, Inc, West Point, PA 19486

^d Bristol-Meyers Products (a Bristol-Meyers Squibb Co), New York, NY 10154

^e SmithKline Beecham Consumer, Pittsburgh, PA 15230

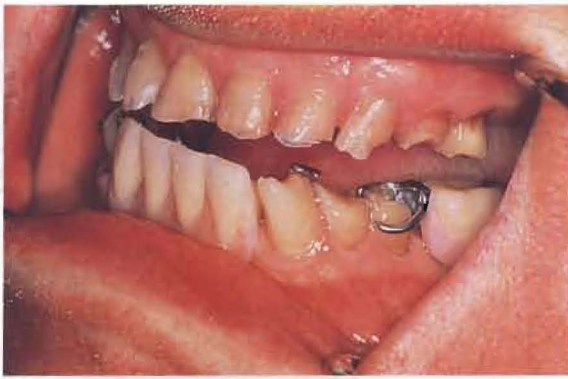


Figure 1—Two chewable 500-mg vitamin C tablets each day created an acidic pH challenge, in addition to a sugar challenge, resulting in erosion of the teeth.

started a letter campaign in an effort to find sources of sugar-free antifungal drugs. She discovered an organization, the American Association of Compounding Pharmacists (9901 S. Wilcrest, Houston, TX 77099; (800) 331-2498), that will make sugar-free preparations.

Medications That Create a Sugar and pH Challenge

In another case, a patient and her dentist were concerned about the appearance of the patient's teeth (Figure 1). On evaluation,

dental professionals had a difficult time explaining the problem. The patient did not have health or behavioral problems such as gastroesophageal reflux, bulimia, or a habit of grinding teeth. The patient's health history indicated that she was very health conscious. She exercised, watched her diet, and, in general, took good care of herself. As part of her health care regimen, she took 2 chewable 500-mg vitamin C tablets daily. The vitamins caused the resting pH of her mouth to be 2.0. This acidic pH, in addition to the sugar challenge, was very harmful to her tooth enamel (Figure 1).

Even health-conscious parents do not hesitate to give cough drops to their children. Some cough drops are vitamin C enhanced; so, in effect, they are a sugar delivery system with an acid pH. Parents

may be more guarded about giving their children candy, but cough drops with vitamin C may create a more serious challenge in the oral cavity than candy.

Medications That Create Conflicts

Besides the sugar challenge caused by antacids, they may also create antagonistic effects with other medications. For example, antacids may complex with other drugs and lower the absorption of those drugs from the gastrointestinal tract (Table 2). They can increase the release of enteric-coated drugs, lower the absorption of drugs requiring an acid pH, and complex with tetracyclines and similar types of medications.⁵ Therefore, dentists have to consider that although these products cause caries and erosion and support plaque formation, they also affect the impact other medications can have on the main course of therapy.

A significant number of OTC drugs can cause other antagonistic effects. For example, the aluminum-salt-containing group of OTC drugs can decrease the absorption of tetracycline, digoxin, indomethacin, iron salts, or benzodiazepines (Table 2).⁵ This group also has a high sugar content.

Medications That Affect Gingival Tissue

Several medications affect the gingival tissue, including phenytoin, calcium channel blockers, cyclosporin, and amphetamines (Table 3). Patients taking these products may need adjunctive plaque-control agents to minimize gingival enlargement. Because can also be caused by diseases such as leukemia, dentists must be able to differentiate between gingival enlargement caused by illness, and from that caused by medication.

Table 2—Antacids That Can Affect Absorption of Other Drugs

Generic Name	Brand Name(s)	Interactions With Other Drugs
Aluminum salts	AlternaGEL® Liquid, Alu-Cap™, Aluminum Hydroxide Gel, Alu-Tab™, Amphojel®	Decreased absorption of tetracyclines, digoxin, indomethacin, iron salts, benzodiazepines
Calcium salts	Tums®, Mylanta® Soothing Lozenges, Mylanta®, Mylanta® DS,	Decreased absorption of tetracyclines
Magnesium salts and aluminum salts	Maalox® TC, Delcid, Gelusil® II, Maalox®, Mylanta®, Riopan®, Gelusil®, Mylanta® DS, Aludrox®, Phillips® Milk of Magnesia	Decreased absorption of tetracycline, digoxin

Adapted from the *ADA Guide to Dental Therapeutics*.⁵



Figure 2A—Phenytoin caused severe gingival enlargement in this 14-year-old patient.



Figure 2B—25 years later (after surgery and orthodontics), the gingival enlargement is controlled with a home oral-care program that includes today's effective plaque-control products, even though the patient is still taking the same dose of phenytoin as in Figure 2A.

Phenytoin

According to the literature, about 50% of patients taking phenytoin (Dilantin®¹) experience enlargement of the gingival tissue.⁶ Although patients who take phenytoin tend to have very inflamed gingival tissue, they do not have much alveolar bone loss compared with an age-matched population.⁷ So, phenytoin may have some protective effect on bone.

A 14-year-old patient had severe gingival enlargement as a result of taking Dilantin® (Figure 2A). In this case, neither the dosage nor the medication itself could be changed or substituted because it could result in convulsions. An orthodontist did not recommend putting brackets on this patient's teeth because of the severe enlargement. Instead, surgery was performed, and a strict plaque-control program was instituted. Three months postsurgery, the patient was doing very well, although a little gingival enlargement recurred from use of the medication.

To test the effectiveness of good oral hygiene, the orthodontist impinged bands on the gingiva. Very little enlargement occurred, suggesting that good oral hygiene can minimize gingival enlarge-

ment, even in the presence of medication known to cause enlargement. The orthodontist then began treatment to move the teeth, again with no serious enlargement occurring. The patient has been monitored for 25 years and appears to have controlled the extent of gingival enlargement with a successful oral hygiene program (Figure 2B).

It should be noted that initially, this patient received professional prophylaxis once a month, in addition to an intensive home-care program using an oral irrigator, a power toothbrush, and assistance with flossing. With the effective plaque-control products currently available, his oral hygiene program can now be further simplified.

Calcium Channel Blockers

Studies show that gingival enlargement occurs in an average of 30% of patients taking calcium channel blockers.⁸ Gingival enlargement was beginning to develop in a patient who had been taking a calcium channel blocker for 2 months (Figure 3). This patient would have developed severe gingival enlargement if dental professionals had not intervened. Intervention includes a meticulous oral hygiene program using products specifically designed for the control of plaque and gingivitis.

Research using the phenytoin model showed that gingival enlargement can be minimized if a patient begins a strict plaque-control pro-

Table 3—Medications That May Cause Gingival Enlargement

Agent	Generic Name	Brand Name
Anticonvulsant	Phenytoin	Dilantin®
Cardiovascular (calcium channel blockers)	Diltiazem	Cardizem® ^a
	Nifedipine	Procardia® ^b
Immunosuppressant	Cyclosporin A	Sandimmune® ^c

Adapted from the *ADA Guide to Dental Therapeutics*.⁵

^a Hoechst Marion Roussel, Kansas City, MO 64134

^b Pfizer Inc, New York, NY 10017

^c Novartis Pharmaceuticals Corp., East Hanover, NJ 07936

¹ Parke-Davis, Div of Warner-Lambert Co, Morris Plains, NJ 07950



Figure 3—Small areas of gingival enlargements developed after using a calcium channel blocker for 2 months.

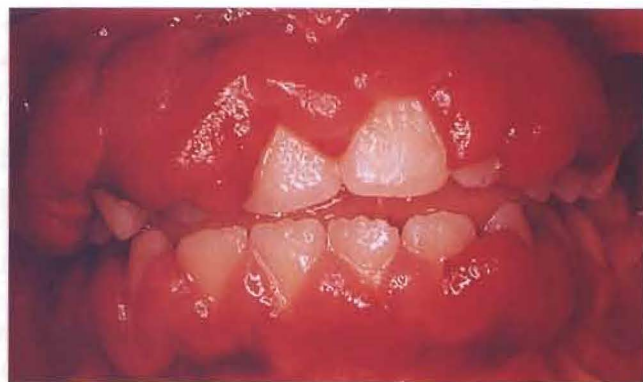


Figure 4—Gingival enlargement in a patient taking cyclosporin.

gram within 10 days of starting medications that cause enlargement.^{9,10} This is a critical message that the dental community needs to communicate to medical schools and physicians.

Cyclosporin

The gingival tissue is affected in about 25% of people taking cyclosporin.¹¹ It is used in patients who have had liver, heart, or kidney transplants. Cyclosporin is a very difficult drug to substitute.

Again, early intervention can prevent severe gingival problems.^{12,13} Figure 4 shows a patient taking cyclosporin; note that the tissue is practically growing over the teeth. Meticulous plaque control early in therapy can minimize this gingival enlargement.

Amphetamines

Researchers know that amphetamines can cause fibrous enlargements in the attached gingiva, although they are unsure of the percentage of affected amphetamine users (personal observation, 1996). Physicians often see this enlargement in children who are being treated for hyperactivity with amphetamines.

Medications That Affect Gingival Crevicular Fluid

Some medications can alter the flow of gingival crevicular

fluid. There is a direct relationship between crevicular fluid flow and inflammation.¹⁴ The more flow, the greater the degree of inflammation. The causal relationship is not clear at this time, although the inflammation probably causes the increased flow. A number of drugs alter inflammation that also have some antigingivitis and antiperiodontitis benefits. These drugs may work by either increasing or decreasing the flow of crevicular fluid.

Some medications... may be beneficial in slowing the progress of periodontal disease by altering the environment for the bacterial microflora.

Some medications change the content of the gingival crevicular fluid. Some diabetics take hypoglycemics to lower their blood sugar, which also lower the sugar levels in the gingival crevicular fluid.¹⁵ Therefore, these drugs may be beneficial in slowing the progress of periodontal disease by altering the environment for the bacterial microflora.

Freeman et al studied the use of gold salts in preventing periodontal disease in an animal model.¹⁶ Gold salts may be antibacterial and, therefore, may be of more value in treating periodontal disease. These benefits also have been seen in patients taking arthritis medications that contain gold salts.

Therefore, some systemic medications may be beneficial in altering the progress of periodontal disease. More research needs to be done in this area to identify other systemic medications that alter crevicular fluid content.

Medications That Cause Xerostomia

Xerostomia, or dry mouth, is a side effect of approximately 200 to 500 medications (Table 4).¹⁷ Xerostomia is most commonly seen with patients using antihypertensives, analgesics, sedatives, tranquilizing agents, antihistamines for allergies, and anti-parkinsonism drugs.¹⁸ Dentists must consider whether the xerostomia is from medications or some other health condition. For example, xerostomia is also seen in patients with Sjögren's syndrome, endocrine disorders, nutritional deficiencies, stress, depression, or patients who have undergone radiation therapy or chemotherapy. Clinicians also need to recog-

nize the possibility that complaints associated with perceived salivary dysfunction may be psychogenic.¹⁹ In each case, the cause of the xerostomia needs to be understood to recommend appropriate treatment.

A 1990 study by Streckfus et al looked at the effect of antihypertensives on the oral cavity.²⁰ In this study, two groups of patients were matched for age; sex; number of decayed, missing, and filled teeth; and oral hygiene status. Bone loss was very similar for both groups; however, the group taking antihypertensives had dry mouth and 60% more root surface caries as compared with the control group. Root surface caries will be one of the major problems with which dental professionals are faced as we move into the 21st century, because the population is living longer and taking more medications that cause dry mouth and its associated problems.²¹

Phenothiazines produce xerostomia, candidiasis, and can also decrease calculus formation.²² Therefore, these patients need additional plaque, gingivitis, and tartar control products.

Xerostomia concerns dental professionals for several reasons. First, oral candidiasis is one of the major side effects of drugs that dry the mouth. Clinicians will see an increasing prevalence of oral candidiasis, but it will be low grade, so it will not have the obvious clinical "cottage cheese" appearance. Clinicians also will see more recurrent and root surface caries, as well as excess plaque formation and all of its associated problems. Lastly, patients wearing dentures will have severe denture retention problems as a consequence of decreased saliva.

Oral health and personal care companies need to design products to help clinicians treat these

problems. For example, a number of products can be applied to the root surfaces for both sensitivity and anticaries effects, such as the fluoride varnish Duraphat[®] and Fluor Protector C[™]. Other professional fluoride products, such as PreviDent 5000 Plus[®], a prescription toothpaste, have been shown to be beneficial for daily use in special-needs patients. Saliva substitutes can be used to a limited extent, in addition to sugarless candies, Gel-Kam[®] rinse or gel, and prescription medications such as pilocarpine. However, topical agents are preferable because of the many side effects that can develop with systemic products.

Xerostomia is a major problem in this country today, and its incidence and side effects will continue to increase. Topical and systemic treatments will become more significant to helping the growing population of xerostomic patients.

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Medications That Alter Host Factors

Tetracyclines inhibit collagenase activity, as well as the release of collagenase by polymorphonuclear leukocytes and inhibit.²³⁻²⁶ Nonsteroidal anti-inflammatory drugs reduce prostaglandin levels by inhibiting the production of arachidonic acid.²⁷

[®] Colgate Oral Pharmaceuticals, Canton, MA 02021

^h Ivoclar Vivadent, Amherst, NY 14228

Table 4—Xerostomia-Associated Drug Categories

Anorexiants agents
Antianxiety agents
Anticholinergic/antispasmodic agents
Anticonvulsant agents
Antidepressant agents
Antidiarrheal agents
Antihistamines
Antihypertensive agents
Antinausea agents
Antiparkinsonism agents
Antipsychotic agents
Bronchodilators
Decongestant agents
Diuretics
Muscle relaxant agents
Narcotic analgesics
Nonsteroidal anti-inflammatory drugs
Sedatives
Smoking cessation agents

Adapted from the *ADA Guide to Dental Therapeutics*.⁵

Medications That Present Diagnostic Challenges

It can sometimes be difficult to diagnose dental problems associated with medications. The following case studies provide examples of unusual complications.

ACE Inhibitors

Vasotec[®] and Capoten[®] are angiotensin-converting enzyme (ACE) inhibitors. A side effect of this category of drugs is that they tend to cause angioedema.²⁸ Some clinicians might mistakenly think patients on these drugs have a periodontal or endodontic abscess that is causing facial swelling. Angioedema also can be caused by denture adhesives. However, if this condition is not dental related, the medication must



Figure 5A—Nitroglycerin tablets placed under the lip on the central incisor, instead of under the tongue, caused this localized tooth destruction. Calcium channel blockers caused gingival enlargement. Many of this patient's medications caused xerostomia.



Figure 5B—The central incisor was restored 3 months after surgical correction of the gingival contour. The patient continued to use a chlorhexidine rinse for plaque control, which resulted in slight tooth discoloration.



Figure 6—Minocycline-associated pigmentation (adjacent to the area of biopsy) at the mucogingival junction and in the maxillary teeth.

be stopped or the trachea may become constricted. A clue to identifying whether ACE inhibitors are causing the condition is that these patients tend to get a hoarse voice before the onset of the angioedema.

ACE inhibitors also can cause lichenoid lesions and mucositis. Therefore, all possible medication side effects must be considered by both physicians and dentists.

Medication Misuse

Some medical care programs have contributed to an increase in medication complications. For example, some patients often see different physicians at each visit, leading to inconsistencies in their treatment plans.

In one case, a patient received different medications from differ-

ent physicians for the same medical condition. This patient was taking two calcium channel blockers simultaneously when only one was needed, which resulted in enlarged gingival tissue. He presented to his

dentist with the chief complaint of a hole in his central incisor that he wanted filled (Figure 5A). The clinician noticed that there was not much general decay. The patient had xerostomia as a result of taking so many medications. He also had trouble swallowing pills. This patient had a history of angina for which he was taking nitroglycerin, which is administered by putting the medication in the buccal mucosa, in the back of the mouth, or under the tongue. To avoid gagging as a result of the xerostomia, the patient was putting his nitroglycerin tablets under his lip over his maxillary right incisor. The pH of the medication caused the hole in the incisor, which was corrected with a restoration (Figure 5B). The patient is also using a chlorhexi-

dene rinse because of his need for better plaque control.

More and more medications are being developed that will be delivered either by placing them in the buccal mucosa or under the tongue. Physicians, dentists, and pharmacists must emphasize to patients the importance of using these medications as prescribed.

Bronchodilators

Although oral candidiasis is a problem that often results from xerostomia, candidiasis of the gingival tissue also can result from the use of bronchodilators. This type of candidiasis presents as slight-to-moderate gingivitis that may be localized or generalized.

Asthma is increasing throughout the world, probably as a result of environmental problems such as air pollution. The guidelines for patients with moderate to severe asthma now recommend steroid-based drugs to control the inflammation of the airways, with bronchodilators as a backup. One of the side effects of these products is that they cause an overgrowth of candida in the mouth. First, dentists need to make the correct diagnosis of this condition: it is a fungal-related gingivitis, not a bacterial-related gingivitis. Then, dentists need to prescribe the appropriate antifungal agents for

these patients and advise them to thoroughly rinse their mouths with water or a mouth rinse after using these inhaler products.

Medications That Cause Pigmentation

Some medications can cause discoloration of the oral tissues, mimicking a Kaposi's sarcoma, lead pigmentation, or amalgam tattooing. For example, a tetracycline called minocycline, which is used for acne, can cause a black pigmentation line in the gingival tissue (Figure 6). Minocycline has an affinity for bone, which can cause the extraction socket of a patient using this medication to appear black or gray. Mercury-containing diuretics can have a similar effect. In addition, minocycline may result in a black to gray discoloration of permanently erupted teeth in adults.²⁹

Conclusion

Medications can have many adverse effects on a patient's oral health. Therefore, in addition to finding new approaches to diagnosing and treating patients, dentists must always take thorough medical histories and update them at each patient visit. Manufacturers, clinicians, and researchers need to guide practitioners and patients to the products that will best help them in their overall oral and systemic health.

We all have a role in solving these medication-related dental problems. Pharmaceutical manufacturers must design medications with delivery mechanisms and composition that are not harmful to patients' oral health. Dental practitioners must be aware of the potential caries and periodontal disease complications that medications can create, and develop the appropriate treatment plans for their patients. Patients must under-

stand the need for keeping all of their health professionals, both medical and dental, informed of their medical conditions and the medications they take regularly. Patients must also understand the importance of using medications in the prescribed manner. Finally, physicians and pharmacists must warn patients about all of the side effects, including those that affect the oral cavity, associated with any prescription or OTC medication that they recommend to a patient.

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