

## Clinical Management of the Dental Patient Taking Multiple Drugs

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### Abstract

Adverse drug reactions (ADRs) occur often in elders often due to polypharmacy. Those over 65 currently comprise 13% of the population but consume approximately a third of all drugs prescribed. Increased care when prescribing certain drug classes and careful monitoring of the patient can prevent many ADRs. This article examines four questions that should be addressed when providing dental care for an older patient taking multiple medications. These include: (1) what are the medical conditions that necessitate the medications, (2) what impact do these medical conditions have on the provision of care, (3) what are the oral side effects of the medications, and (4) how will the patient's current list of medications alter the dentist's prescribing patterns for drugs used in dentistry?

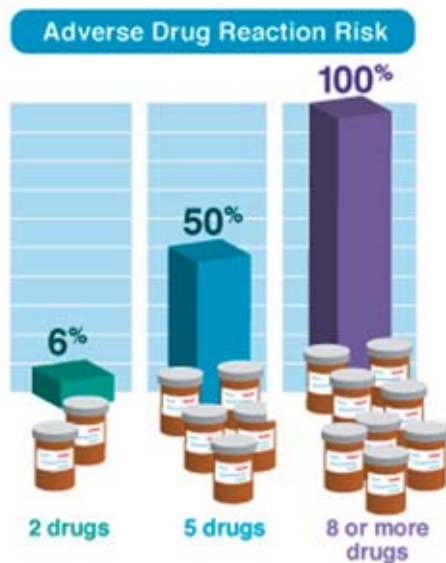
**Keywords:** Polypharmacy, geriatrics, dental, adverse drug reactions, ADRs

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## Introduction

In the dental office an adverse drug reaction (ADR) (See Table 1) may occur with the administration of even a single drug. The risk of an ADR increases when managing patients on multiple medications for multiple diseases. Forty percent of seniors take an average of three medications.<sup>1</sup> As the population ages, the number of patients with chronic diseases taking multiple medications (polypharmacy) increases.<sup>2</sup> By the year 2030 it is expected individuals over 65 years of age will compose 20% of the population, and the group over 85 will almost double in number. Those over 65 currently comprise 13% of the population but consume approximately a third of all drugs prescribed.<sup>1,3</sup>



ADRs occur more often in elders, for a variety of reasons, but are often due to polypharmacy. The risk increases for those who are malnourished or have renal or hepatic diseases, diabetes, asthma, or other systemic diseases.<sup>1</sup> The potential risk of an adverse reaction rises from 6% with two drugs, to 50% with five drugs, and 100% with eight or more medications.<sup>4,6</sup> Studies have shown prevalence rates of 10-35% for ADRs in community dwelling elders.<sup>4</sup> Several studies examining community dwelling elders<sup>4</sup>, institutionalized frail elders<sup>7,8</sup>, and hospitalized elders<sup>9</sup> have shown that as the number of prescribed drugs increases the occurrence of ADRs also increases.

In the dental setting, as well as in the medical setting, a thorough health history, increased care when prescribing certain drug classes, and careful monitoring of the patient can prevent most of these ADRs.<sup>1,3,4,5</sup> This article presents a framework for evaluating and managing patients on multiple medications (See Table 2). It examines four areas of concern when providing dental care for an older patient taking multiple medications: (1) medical conditions that necessitate the medications, (2) the impact these medical conditions have on the provision of care, (3) the oral side effects of the medications, and (4) the impact of the patient's current list of medications on the dentist's prescribing patterns for drugs used in dentistry.

## Identify Medical Conditions Necessitating The Drug And Its Potential Impact On The Provision Of Dental Care

When a patient presents with a lengthy medication list, a primary concern is whether or not there are medications on the list that may be required in the event of an emergency. The patient's drugs should be categorized to identify immediate safety considerations, i.e., grouping the drugs by classes: anticoagulant, anti-anginal, hypoglycemics, etc. For example, does the patient require nitroglycerin for angina<sup>10</sup> or an inhaler for dyspnea?<sup>11</sup> If so, these drugs should be available during the dental appointment. Secondly, do any of the drugs on the list have the potential to complicate dental treatment? For example, is the patient taking the anti-coagulant Warfarin? If so, has the patient's physician been alerted to the pending dental treatment and have all the necessary lab tests been run and the results available? Has the patient taken their dose of insulin but not eaten, placing them at risk for hypoglycemia?<sup>12</sup> Third, could any

Drug Groups	Example Drugs	Management Problems
Anticoagulants Immunosuppressants	Aspirin, Warfarin <sup>*</sup> Corticosteroids <sup>*</sup> Immunosuppressant organ transplants <sup>*</sup>	Excessive bleeding Increase risk of bacterial and fungal infection, poor wound healing response
Chemotherapeutic agents	Vincristine	Delayed healing, stomatitis, fungal infections
Sedative hypnotics <sup>*</sup> , narcotics, barbiturates	Tylenol #3, Valium, Demerol	Wound healing suppression,sedation
Hypoglycemics	Insulin	Hypoglycemia

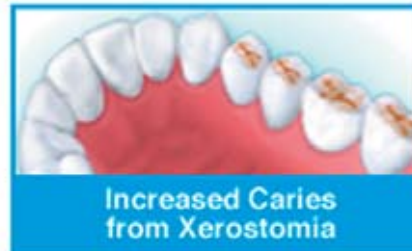
of the medications compromise our treatment outcomes? For example, is the healing time or risk of infection increased because the patient is on immunosuppressants such as Prednisone<sup>13,14</sup> or chemotherapeutics such as Vincristine or Methotrexate?<sup>14</sup>

The clinician should be alert to any highly titrated drugs with a narrow margin of safety, which may increase the risk of an adverse drug event<sup>15,16</sup> (Table 3A). Many natural products can have a physiologic impact that requires altered dental management, so the clinician should be sure to inquire if the patient is taking any natural products (Table 3B).

Reviewing with the patient the indications for all medications on the list allows the dentist the opportunity to clarify the health history and provides important information about the patient and any potential risks or management issues to be considered when treating the patient. In some cases the patient will not be able to effectively communicate their health issues, in which case their medication list may be the dental clinician's only immediate resource for identifying medical problems which are so severe they require pharmacologic intervention. For instance, a patient may not report they have hypertension, but their medication list may include Furosemide, a diuretic.<sup>14</sup> Both the hypertension and the diuretic can have implications on the provision of dental care as well as direct and indirect effects on the patient's oral health.

### Identify Drugs With The Potential For Oral Side Effects

Identifying drugs by class is also important because certain classes of drugs are more likely to result in specific types of oral pathology (Table 4). For example, ACE inhibitors and other drugs are associated with lichenoid reactions<sup>3,17,18</sup>, diuretics and antidepressants could contribute to xerostomia<sup>3,18,19,20</sup>, and calcium channel blockers and some anti-seizure and immunosuppressant drugs can contribute to gingival hyperplasia.<sup>3,18,21</sup> Many medications result in altered taste sensations that, in severe cases, can result in nutritional deficiencies and malnutrition, which can lead to oral changes.<sup>21,22,23</sup> Xerostomia is one of the most common and potentially destructive oral side effect of drugs. It can contribute to an increase in caries and an increased susceptibility



to oral fungal infections. In the aged it can also result in easily traumatized mucosal tissues. Dry mouth can reduce or alter the sensation of taste as well as impair speech and swallowing function.<sup>1,3,5,19,20</sup> The dentist may consult with the patient's physician about changing a xerostomic medication to another. However, for patients on numerous medications that cause xerostomia, only palliative therapy such as salivary substitutes and lubricants may be all that is possible. For dentate patients, management of xerostomia should include caries prevention.

Sometimes oral pathology is a result of a specific medication, exacerbated by poor oral hygiene, such as gingival hyperplasia in patients taking Dilantin for seizure disorders.<sup>21</sup>

Some medications, such as aspirin, may result in a chemical burn if they are misused and placed directly on the oral tissue. Interestingly, even adult teeth can become discolored from tetracycline – specifically minocycline. These oral conditions may require treatment, palliation, and/or preventive measures, which may sometimes include adding another medication to an already long list.<sup>3, 5, 24</sup>

### Create A System For Prescribing

After carefully reviewing the existing medications to assess the patient's systemic condition and considering the potential effects of the medication on oral health, the next consideration relates to drugs administered or prescribed for the patient by the dentist. The first consideration is "are there any absolute contraindications to the medication that will be prescribed," such as a drug allergy?<sup>16</sup> Does the drug have the potential to exacerbate any of the patient's medical conditions (i.e., drug-physiology interaction), such as NSAIDs increasing the risk of gastrointestinal bleeding in a patient with gastric ulcers?<sup>16, 25, 26</sup> Does the drug have the potential to interact with any of the over-the-counter, herbal supplements or medications reportedly taken by the patient such as erythromycin, inhibiting liver enzymes and decreasing the metabolism of the anti-coagulant Coumadin?<sup>14, 27</sup> Patients taking two or more drugs and those whose drug list includes, but is not limited to, anti-convulsants, barbituates antibiotics, digoxin, Warfarin, amiodarone, or dexamethasone are at high risk of developing drug-drug interactions.<sup>16, 26</sup> Many of these drugs are highly titrated and a small change in their blood levels can have a large physiological impact.<sup>16</sup>

Four drugs commonly used in dentistry, erythromycin, clarithromycin, metronidazole, and ketoconazole, inhibit cytochrome P450 enzymes. These enzymes are responsible for metabolizing many drugs. Their inhibition of drugs used in dentistry can significantly decrease the rate of drug metabolism and create a high potential for an ADR. Erythromycin and ketoconazole have the greatest potential to cause such inhibition. So, to avoid the risk of such drug-drug interactions, do not use these drugs in patients already taking other drugs.<sup>16</sup>

It may be useful to review reference books or websites at this point to see if there are any contraindications or precautions to taking a particular drug with a coexisting medical condition or to taking the medication with a currently prescribed medication. These references/resources (Tables 5, 6, and 7) also help explain potential outcomes of ingesting a group of medications at one time. Some resources are very convenient such as Lexicomp's electronic drug interaction software that allows you to enter the drug in question and cross check it for interactions. Importantly, pharmacists can also be consulted to clarify seemingly ambiguous information.<sup>1, 16, 26</sup>

It is important to note most medications prescribed for dental purposes are prescribed for only a short duration and many have a large margin of safety, which reduces the risk of ADRs.<sup>16, 28</sup> It may also be possible, in consultation with the patient's physician, to temporarily change or suspend an interacting medication they have prescribed during the duration of the dental prescription, though that is seldom necessary.<sup>16</sup>

In order to avoid drug toxicity the prescriber must be aware of how the drug will be eliminated when selecting a drug or determining dosages. This is especially important if the patient has known renal or hepatic disease, since these are the most common routes of elimination. If they are available, some laboratory values may serve as guidelines for prescribing drugs eliminated by the kidney or liver (Table 8).

Patients of advanced age may be at increased risk of suffering the respiratory depressive effects of some medications such as benzodiazepines and opioids. They may be less able to compensate quickly for medications that alter cardiovascular function, such as epinephrine<sup>1</sup>, and they may have an atypical adverse drug response such as altered mental status.<sup>4, 29</sup> It should be noted few adverse drug events have been clearly attributed to the changes that occur in the processes of absorption, distribution, and elimination as a result of normal aging.<sup>1, 3</sup> Risks associated with altered drug metabolism and elimination are almost always due to the presence of a known systemic disease affecting cardiac, kidney, or liver function.<sup>1, 3, 5</sup>

Some drugs present an increased risk of toxicity in older individuals, even without a drug interaction. In addition to screening for potential adverse drug interactions knowledge of maximum doses of the drugs to be prescribed for a dental purpose is critical whether the individual is a child, healthy adult, an individual with renal failure, or a frail elder.<sup>1, 16</sup> A decrease in dosage for aged individuals may be recommended for some medications commonly used in dentistry<sup>29</sup> (Table 9). Due to normal physiologic changes in elimination associated with aging and altered distribution as a result of decreased body mass, dosage of these drugs should be reduced by 50% or to the lowest therapeutic dose for individuals under 100 pounds and patients over 85 years old.<sup>29, 30, 31</sup>

It is important to keep in mind the characteristics of the drugs frequently prescribed in dentistry along with prescribing patterns. In addition to the short duration of use, the number of frequently prescribed medications is limited and their associated ADRs are well documented and are readily found in reference materials.<sup>5, 14, 16</sup> Drug classes commonly used in general dentistry include analgesics, antibiotics, antifungals, antivirals, anesthetics, vasoconstrictors, and sedatives. There are generally three to five commonly used medications in each class, though generally any one practitioner limits their prescribing pattern to one or two in each class. A limited list of these drugs and their potential drug interactions are found in Table 10. The individual provider should be very familiar with the properties of the drugs they commonly use.

A report can be made to the Federal Drug Administration if after all precautions have been taken and an unexpected ADR appears to have occurred, either from a single or a combination of prescriptions (<http://www.fda.gov/medwatch/report/hcp.htm>). Any patient could have an idiosyncratic reaction or an unexpected outcome to a medication.<sup>16</sup> However, most potential adverse drug effects, events, and interactions can and should be anticipated so they can be prevented.<sup>1, 3, 4, 16</sup>

The dental provider, of course, bears responsibility for ADRs related to medications prescribed for oral health reasons. But, it should

be noted the dental care provider does not have the responsibility of identifying and eliminating risks for ADRs among medications prescribed by other providers. That is the responsibility of the physicians, nurses, and pharmacy staff who prescribe and dispense those medications. However, if an ADR is suspected or evident, it should be brought to the attention of the other providers.

### Conclusion

Managing patients who have multiple diseases and are taking multiple medications is complex and comes with risk. The dentist should be prepared to safely manage such patients. In the year 2000, 2.8 billion prescriptions were filled in the United States, enough for everyone to have ten prescriptions. So far there has not been a clear estimate of ADRs that occur for outpatients. It is estimated each year approximately 350,000 ADRs occur in nursing homes and over two million occur in hospitals with over 100,000 of those resulting in death.<sup>26</sup>

The medical conditions necessitating polypharmacy and the medications themselves will impact our patients' oral health and the way we practice. Evaluating the potential for adverse outcomes of polypharmacy in the aged is often complicated by the presence of several chronic diseases or conditions that may impair communication, cognition, and/or the ability to comply with a complicated drug regimen.<sup>1, 5, 16, 31</sup> The complexity of these situations calls for more than diligence on the part of the practitioner. It is necessary to complete a careful review of the patient's health history and have knowledge of the appropriate uses and limitations of our dental drug armamentarium. Dental providers should be familiar with their physician and pharmacy colleagues and be familiar with easy to access, up-to-date medical and pharmacological information. Dental providers will have to reach across disciplines to remain current and informed, as well as to inform others, about the adverse effects on oral health from medical diseases and their management. They must also be knowledgeable about their individual patients' diseases and medications in order to better prevent ADRs and untoward outcomes to dental treatment.

**Table 1. Types of adverse drug reactions.** <sup>14, 16, 32, 33</sup>

Allergic	Administration of the drug causes an undesirable immunologic response, i.e., rash, anaphylaxis, which is often unpredictable.
Side effect	Undesirable effect occurs which is expected or predictable at therapeutic doses, i.e., nausea, dry mouth. Side effects are the most common adverse effects.
Drug toxicity	Occurring most commonly in children and frail elders, this is when a physiologic system is damaged from doses over therapeutic levels, i.e., nephrotoxicity from over ingestion of NSAIDs. Toxicity is usually predictable.
Drug-drug interaction	The absorption, distribution, metabolism, and/or excretion of one drug is altered by the administration of another drug, i.e., erythromycin taken with digoxin increases the digoxin level or NSAIDs and methotrexate interactions are usually predictable.
Drug-physiology interaction	The presence of a drug at therapeutic levels adversely alters a physiologic system – can overlap with a side effect, i.e., administration of Clindamycin can result in colitis and diarrhea. Such interactions are usually predictable.
Drug-laboratory test interaction	There is no effect on the physiologic system being tested, but a false positive or false negative test result, i.e., amoxicillin can cause a false-positive urine glucose test. Such interactions are usually predictable.
Idiosyncratic	By definition these are unpredicted physiologic or psychological responses occurring at therapeutic doses. These are unique to an individual.

**Table 2. Steps in the assessment of and prescribing for the polypharmacy patient.**

**A. Review the existing medication list.**

1. **Could any of these drugs be required during a medical emergency?**

e.g., Nitroglycerin – angina<sup>10</sup>; Inhalers – COPD exacerbation<sup>11</sup>

2. **Why is the patient taking these particular medications? Group by category to aid in assessing overall risk in patient care and management.**

e.g., antihypertensive, anticoagulant, immunosuppressive, antidepressant, etc.

3. **Do any have the potential to contribute to a complication or even create an emergency situation?**

e.g., Warfarin – excessive bleeding<sup>1</sup>; Prednisone – adrenal insufficiency<sup>3</sup>; Insulin – hypoglycemia<sup>16</sup>

4. **Could any of these drugs compromise our desired treatment outcome?**

e.g., Vincristine – delayed healing<sup>14</sup>; Echinacea – inhibition of erythromycin and ketokonazole<sup>34,35,36</sup>

5. **Do any of these drugs have potential oral side effects?**

e.g., Dilantin, Nifedipine - gingival hyperplasia; calcium channel blockers - lichenoid reactions; antihistamines, diuretics – xerostomia<sup>5,14,18,24</sup>

**B. Considerations prior to administering or prescribing dental related medications**

1. **Does this person have a specific drug allergy to a drug you intend to prescribe?**

e.g., taking penicillin has resulted in a skin rash<sup>14</sup>

2. **Is this drug contraindicated for use given any of this patient's medical conditions?**

e.g., NSAIDs with history of gastrointestinal ulcers or alcohol abuse<sup>14,37</sup>

3. **Is there a potential for an adverse drug interaction with the patient's existing medications?**

e.g., erythromycin reducing Warfarin clearance by 30%<sup>14,27</sup>

4. **Where will the dental drugs be metabolized and is there any indication drug**

**elimination will be a problem for this patient?**

e.g., elderly may have decreased elimination of penicillin, cephalosporin, erythromycin<sup>29</sup>; bisphosphonates – bone necrosis<sup>45</sup>

Table 2. Continued

<p><b>5. Could any of the dental drugs contribute to an emergency situation?</b></p> <p>e.g., Prednisone – risk of non-compliance and patient failing to take prescribed dose resulting in adrenal crisis<sup>1,14,16</sup></p> <p><b>6. Is the dose prescribed in a safe range for the patient’s size and state of health, i.e., at or below the maximum safe dose?</b></p> <p>e.g., Acetaminophen prescribed should not exceed 4g per day for adults, but hepatotoxicity has occurred with &lt; 4g in patients with cirrhosis<sup>14,32</sup></p>
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Table 3a. Potential drug related oral health/management complications.

Drug Groups	Example Drugs	Management Problems
Anticoagulants	Aspirin, Warfarin*	Excessive bleeding
Immunosuppressants	Corticosteroids* Immunosuppressants for organ transplants*	Increase risk of bacterial and fungal infection, poor stress response
Chemotherapeutic agents	Vincristine	Delayed healing, mucositis, fungal infections
Sedative hypnotics*, narcotics, barbiturates	Tylenol #3, Valium, Demerol	Respiratory suppression, fall risk
Hypoglycemics	Insulin*, sulfonylureas	Hypoglycemia
Bisphosphonate bone stabilizers	Pamidronate (Aredia) Alendronate (Fosmax)	Delayed bone healing, bone necrosis

\*highly titrated drugs – narrow margin of safety<sup>1,3,16</sup>

Table 3b. Natural products that may alter dental management.<sup>34, 35, 36, 38, 39</sup>

Compound	Possible Dentally Relevant Problem
Feverfew Garlic Ginger Ginko Biloba Bilberry Dong Quai St. John’s Wort	May increase bleeding
Echinacea St. John’s Wort	These herbs inhibit liver enzymes so they may potentiate the liver enzyme (cytochrome P450) inhibiting the effect of erythromycin and ketokonazole.
Ephedra (Ma-Huang) Bitter orange	May increase blood pressure and heart rate due to anxiety or if epinephrine/vasoconstrictor used.
Kava-Kava	Hepatotoxicity, especially in those taking other medications metabolized in the liver. Sedative effects.
Valerian	May potentiate the effects of sedative Hypnotics and anti-anxiety drugs



Table 4. Oral side effects of drug classes and their possible uses. <sup>3, 5, 14, 16, 18, 24, 40, 41</sup>

Oral side effect	Drug Class	Example (Generic)	May be used to treat:
<b>Xerostomia</b>	Antihistamine	Claritin (Loratadine)	Hay fever
	Antidepressant	Zoloft (Sertraline)	Obsessive Compulsive Disorder
	Antihypertensive Calcium channel blocker	Norvasc (Amlodipine)	High blood pressure
	Diuretics	Lasix (Furosemide)	High blood pressure
<b>Fungal infection</b>	Antibiotics	Tetracycline	Periodontal disease
	Immunosuppressant	Prednisone	Rheumatoid Arthritis
<b>Mucositis</b>	Anti-neoplastic	Adrugil (5-fluorouracil)	Chemotherapeutic for breast cancer
<b>Tooth discoloration</b>	Antibiotics	Minocin (Minocycline)	H.Pylori caused gastric ulcers
	Antimicrobials	Peridex (chlorhexidene)	Periodontal disease
	Fluorides	Stannous Fluoride	Cavity prevention
<b>Dygeusia</b>	Oral hypoglycemics	Glucotrol (Glipizide) Vasotec	Anti-diabetic
	Anti-hypertensive Ace inhibitor	(Enalapril)	Hypertension
<b>Gingival hyperplasia</b>	Anti-convulsant	Dilantin (Phenytoin)	Epilepsy
	Anti-hypertensive Calcium channel blocker	Procardia (Nifedipine)	High blood pressure
	Immunosuppressant	Sandimmune (Cyclosporin)	Prevent organ transplant rejection
<b>Stomatitis</b>	Anti-hypertensive Ace Inhibitor	Capoten (Captopril)	High blood pressure
<b>Lichenoid reactions</b>	Diuretics	Thiazide (HCTZ)	High blood pressure
<b>Mucosal Burns</b>	Anti inflammatory	Ecotrin (Aspirin) - if dissolved in the mouth	Osteoarthritis
<b>Delayed Bone Healing Bone Necrosis</b>	Bisphosphonates	Pamidronate (Aredia)	Bone loss in cancer
		Alendronate (Fosmax)	Bone necrosis

**Table 5. Useful Internet based Web sites relative to drugs and drug interactions.**

[www.ada.org](http://www.ada.org) - The American Dental Association web site contains resources and connects to a variety of medically related sites. Members can look through a long, well-researched list of useful web sites related to drugs and health.

[www.dentalgate.com](http://www.dentalgate.com) - This site has two different search features, one for the World Wide Web and another for medicine, especially designed for dentistry.

[www.drugs.com](http://www.drugs.com) - This is a comprehensive and up-to-date prescription drug information site for consumers and professionals with fast, easy searching of over 24,000 approved medications.

[www.drweil.com](http://www.drweil.com) - This site contains pages called "Herbal Medicine Chest" and "Home Health Remedies" describes availability, dosages, and warnings. The site is available to the general public.

[www.factsandcomparisons.com](http://www.factsandcomparisons.com) or [www.drugfacts.com](http://www.drugfacts.com) - This site contains headlines, drug updates, recent drug approvals, and information on resources for purchase as well as an option to subscribe to "efacts" which provides drug facts and comparisons, as well as information about herbals, OTC meds, and chemotherapeutics and a host of other topics.

[www.fda.gov/cder/drug/default.htm](http://www.fda.gov/cder/drug/default.htm) - The Center for Drug Evaluation and Research web page has information on all the drugs regulated by the FDA, which is all drugs.

[www.fda.gov/opa/com/hpchoice.html](http://www.fda.gov/opa/com/hpchoice.html) - This site provides information on adverse reactions.

[www.healthgate.com](http://www.healthgate.com) - This site provides access to medicine searches as well as health news.

[www.hiv-druginteractions.org](http://www.hiv-druginteractions.org) - An excellent site for HIV drug interactions as well as interactions with recreational/abuse drugs and with herbs.

[www.lexi.com](http://www.lexi.com) - This site offers handheld software, downloadable updates, access to Lexi-Comp Online for member health professionals including Lexi-Interact and Lexi-Drugs for Dentistry, new drug information, and special alerts and patient education.

[www.mcp.edu/herbal](http://www.mcp.edu/herbal) - This site includes in-depth monographs, clinician information summaries, patient fact sheets, interactions and toxicity information for herbal medicines, dietary supplements, vitamins and minerals. The site is available to the general public.

[www.medscape.com](http://www.medscape.com) - This is a searchable site with an extensive medical-based home page that can be customized for your personal interests. It will send topics, such as pharmacology updates, to your computer to allow you to keep current on areas of interest.

[www.mosbysdrugconsult.com](http://www.mosbysdrugconsult.com) - This site contains full prescribing information for pharmaceuticals. It also includes customizable patient information handouts in English and Spanish and drug interactions software.

[www.naturaldatabase.com](http://www.naturaldatabase.com) - This site contains a drug interaction checker and an interactive component for health professionals.

**Table 5. Continued**

[www.nlm.nih.gov](http://www.nlm.nih.gov) - This site has a powerful search feature that looks at a large range of databases and searches out complete articles on specific topics.

[www.pdrhealth.com](http://www.pdrhealth.com) - Registration is free, includes information on pharmaceuticals and herbals.

[www.personalhealthzone.com/pg000059.html](http://www.personalhealthzone.com/pg000059.html) - Prescription drug interactions and warnings relative to herbs and supplements.

[www.purecaps.com](http://www.purecaps.com) - Members and nonmembers can access the site for information on alternative medicinals that includes: botany, usage, active constituents and mechanisms of action, dosages, cautions and contraindications, as well as depletions and interactions by drug name.

[www.rxlist.com](http://www.rxlist.com) - This site has a very comprehensive list of drug indications, contraindications, interactions, etc. It also has an extensive list of medical diseases and how they are managed. Some of the explanations of the diseases are presented in a short video interview format, which makes it an interesting educational resource.

[www.seniorcarepharmacist.com](http://www.seniorcarepharmacist.com) - This site provides Seniors information about managing the medications they are taking and issues specific to elders and medications. The site also assists users in locating specialist in geriatric pharmacology in their area.

**Table 6. Authors choice of drug text references to keep in the office (updated annually).**

Texts may be found in medical bookstores or on line such as noted. Note there may be other online resources besides those noted.

Dental Therapeutics - American Dental Association Guide, 3<sup>rd</sup> Edition ([www.ada.org](http://www.ada.org))

Facts and Comparisons ([www.factsandcomparisons.com](http://www.factsandcomparisons.com) or [www.drugfacts.com](http://www.drugfacts.com))

Lexicomp's Drug Information Handbook for Dentistry, 9<sup>th</sup> Edition. Editors Wynn RL, Meiller TF, Crossley. Hudson Ohio, 2003. ([www.lexi.com/web/index.jsp](http://www.lexi.com/web/index.jsp) , [www.amazon.com](http://www.amazon.com))

The Little Dental Drug Booklet ([www.dentalstudents.com](http://www.dentalstudents.com))

Mosby's Dental Drug Book ([www.us.elsevierhealth.com/Dentistry/index.jsp](http://www.us.elsevierhealth.com/Dentistry/index.jsp))

Natural Medicines Comprehensive Database 5<sup>th</sup> Ed. ([www.amazon.com](http://www.amazon.com))

2004 Physician's Desk Reference ([www.pdrbookstore.com/Merchant2/merchant.my](http://www.pdrbookstore.com/Merchant2/merchant.my), [www.amazon.com](http://www.amazon.com))

2004 Physician's Desk Reference for Non-prescription Drugs and Dietary Supplements ([www.pdrbookstore.com/Merchant2/merchant.my](http://www.pdrbookstore.com/Merchant2/merchant.my), [www.amazon.com](http://www.amazon.com))

**Table 7. Available computer and PDA drug information software.**

Software may be found on line such as noted. Note there may be other online resources besides those noted.

Facts and Comparisons, ([www.factsandcomparisons.com](http://www.factsandcomparisons.com) or [www.drugfacts.com](http://www.drugfacts.com))

Lexi-Comp On-Hand Databases: Lexi-Drugs for Dentistry, Lexi-Interact ([www.lexi.com/web/index.jsp](http://www.lexi.com/web/index.jsp), [www.amazon.com](http://www.amazon.com))

Mobile Physician's Desk Reference ([www.pdrbookstore.com/Merchant2/merchant.my](http://www.pdrbookstore.com/Merchant2/merchant.my), [www.amazon.com](http://www.amazon.com))

Mosby's Drug Consult Networkable CD ([www.us.elsevierhealth.com/Dentistry/index.jsp](http://www.us.elsevierhealth.com/Dentistry/index.jsp))

Mosby's Drug Consult Handheld Software ([www.us.elsevierhealth.com/Dentistry/index.jsp](http://www.us.elsevierhealth.com/Dentistry/index.jsp))

Natural Medicines Comprehensive Database ([www.naturaldatabase.com/skyinfo.asp](http://www.naturaldatabase.com/skyinfo.asp))

New Mentor, Dental Drug Booklet ([www.newmentor.com](http://www.newmentor.com))

**Table 8. Guidelines for compromised renal or hepatic function.**<sup>5, 29, 42</sup>

Potential impairment	Examples of dental drugs eliminated	Lab test	Range	Margin of safety for dental prescribing
Renal	Amoxicillin Cephalosporin Penicillin Tetracycline	GFR (Creatinine Clearance)	<10 ml/min 10-50 ml/min >50 ml/min	One dose q 24 hrs One dose q 8-12 hours One dose q 8 hours
Hepatic	Acetaminophen Codeine Diazepam Erythromycin Ibuprofen Ketoconazole Lidocaine Lorazepam Prednisone	AST, ALT, liver transaminases	30-40 u/l	If greater than 4 times normal, do not use drugs that are toxic to or metabolized by the liver

**Table 9. Route of elimination for dental drugs that may require dosage adjustments in frail older patients even in the absence of frank renal or hepatic disease\*.**<sup>1, 29</sup>

Renal Elimination	
Drug class	Drug
Antibiotic	Amoxicillin Cephalosporin Tetracycline
Antifungal	Fluconazole

Hepatic Elimination	
Drug class	Drug
Pain reliever	Ibuprofen
Antibiotic	Erythromycin
Local anesthetic	Lidocaine
Sedative/anxiolytic	Diazepam Lorazepam

\* This does not refer to prophylactic regimens such as those suggested by The American Heart Association for SBE prophylaxis

**Table 10. Adverse outcomes and interactions with common “dental drugs.”<sup>3,4, 14, 27, 32, 37, 38, 42, 43, 44</sup>**  
**(Drugs listed may interact with more than the example drug listed)**

Drug class	Common drugs used in dentistry	Interacts with already prescribed (example)	Potential adverse outcome(s)
<b>Analgesic</b>			
Narcotic	Tylenol #3*	*****	Respiratory depression
Non-narcotic	NSAIDs	Warfarin	Excessive bleeding
		Ace inhibitors	Decreased hypotensive action
		Lithium	Increased serum concentration
	Acetaminophen	Methotrexate	Renal failure
		NSAIDs	Nephrotoxicity
<b>Antibiotic</b>			
	Clindamycin*	*****	Colitis and diarrhea
	Cephalosporin*	*****	Impaired clotting
	Erythromycin+	Digoxin	Increases digoxin level
	Penicillin	Probenecid	Increases PCN concentration
	Metronidazole	Warfarin	Excessive bleeding
<b>Anti-fungal</b>			
	Ketoconazole+	Glyburide	Increased hypoglycemic effect * anticoagulant effect
	Nystatin	None known	
	Clotrimazole	None known	
	Fluconazole	Warfarin	
<b>Anti-viral</b>			
	Acyclovir	None known	
	Val acyclovir	None known	
<b>Anti-inflammatory</b>			
	Prednisone	NSAIDs, Acetaminophen	Hepatotoxicity * side effects of NSAIDs
<b>Anesthetic</b>			
	Lidocaine	*H2-blocker, ranitidine	* lidocaine concentrations
	Prilocaine	CNS depressants	Respiratory depression
	Articaine	CNS depressants	Respiratory depression
<b>Vasoconstrictor</b>			
	Epinephrine	MAO inhibitors	Increased blood pressure
	Levonordephrine	*-blockers for both	
<b>Sedatives</b>			
	Diazepam*	*****	Respiratory depression, fall risk
	Lorazepam	CNS depressant	Respiratory depression, fall risk

\* Increased risk of toxicity and adverse event in the aged – even without a drug interaction

+ Do not use these drugs in patients taking other drugs to avoid the risk of drug-drug interaction.

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