ANTIBIOTICS

Dentists' prescribing behaviors

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BACKGROUND

Antibiotics have saved lives and prevented serious complications in many situations, but their overuse is producing serious adverse health effects. The adverse drug reactions related to antibiotics can range from minor and reversible to severely debilitating or fatal. The greatest concerns are associated with antibiotic-resistant bacteria because patients with infections involving these bacteria are at increased risk of experiencing poor clinical outcomes and death. Resistant microbes pose a serious health threat to the population at large, prompting the World Health Organization to endorse a global action to take steps to combat the problems related to antibiotic overuse. Dentists are prescribing antibiotics at much higher rates than in the past. These prescriptions can be prophylactic or therapeutic and primary or secondary in each classification. The role of dentistry related to the global health issues associated with antibiotic use was explored in a scoping review.

METHODS

The review was conducted between July 2016 and August 2017 and included searches in the Embase, PubMed, Ovid MEDLINE, Scopus, and Google Scholar databases. The objectives were to describe the clinical and nonclinical indications for antibiotic prescriptions in dentistry, to identify the types of antibiotics prescribed and the regimens followed, and to discover factors that influence the antibiotic prescribing patterns of dentists. A total of 118 studies were included, with 81 cross-sectional surveys and 25 prescription audits. Forty-eight focused solely on the use of prophylactic antibiotics, 29 only on the use of therapeutic antibiotics, 29 on both prophylactic and therapeutic antibiotic use, and 12 with no specification.

RESULTS

Forty percent of the studies were classified as offering high-quality evidence. Low levels of evidence were related to selection bias, low response rate or nonresponse bias, reporting bias, and a lack of statistical analysis and control group.

Prophylactic Antibiotic Use

Dentists commonly prescribe primary prophylactic antibiotics to healthy patients having invasive oral health procedures. This includes surgical extractions, implants, and endodontic procedures. However, the evidence supporting the use of antibiotics for these situations is minimal and inconsistent.

Dentists also prescribed antibiotics to patients who are medically compromised, which includes those with rheumatic heart disease, coronary artery bypass graft, mitral valve prolapse, recent myocardial infarction (MI), and total joint replacement (TJR). Guidelines now in place no longer recommend antibiotic prophylaxis for these patients. Two nonclinical factors were identified that influence these prescriptions, specifically, pressure from the patient or the patient's cardiologist or family physician and lack of knowledge or reluctance to adopt the revised guidelines. A key reason for the pressure from medical care providers is believed to relate to differences in their beliefs about whether oral health treatment causes infective endocarditis (IE). Dentists tend to believe that routine daily activities, such as tooth brushing and eating, are more likely to be the primary cause of IE, but cardiologists tend to believe that invasive procedures are the primary cause.

Therapeutic Antibiotic Use

Many dentists prescribed therapeutic antibiotics to patients with a localized fluctuant swelling that was not spreading. However, local treatment would have sufficed in most of these cases. Therapeutic antibiotics were also used for patients with periodontal disease to serve as an adjunct to mechanical therapy, which is effective in a limited number of clinical circumstances. In the majority of studies, it could not be determined if dentists were prescribing therapeutic antibiotics alone or in combination with an operative intervention.

Various barriers or nonclinical factors hindered dentists' use of antibiotic prescriptions in oral health settings. These factors held sway even when dentists knew about clinical guidelines and research evidence that could directly influence the use of antibiotics.

Drug Specifics

Amoxicillin was the primary choice for both prophylactic and therapeutic antibiotic use. Often the regimen selected for prophylaxis was not in line with the recommendations of the American Heart Association (AHA). This could reflect slowness in adopting AHA guidelines. For therapeutic uses, the amoxicillin was often combined with clavulanic acid. Penicillin VK remains the drug of choice for the initial treatment of odontogenic infections, but amoxicillin use was more common, probably because of its longer dose interval, activity against certain gram-negative anaerobes, and ability to be taken with food, which leads to better patient compliance. Dentists also prescribed metronidazole for odontogenic infections. Although it is the drug of choice for treating chronic infections in which anaerobes predominate and for acute necrotizing ulcerative gingivitis and pericoronitis with systemic involvement or persistent swelling, it's not active against aerobes, making it unsuited for most odontogenic

Table. Indications for Antibiotic Use in Dentistry and Corresponding Antibiotic Regimens as Recommended by Organizational Guidelines or Frequently Endorsed in the Literature

Prophylactic Antibiotic Regimens		Therapeutic Antibiotic Regimens	
Indication	**Regimen (Adults)**	**Indication**	**Regimen (Adults)**
Implant Placement in Patients at High Risk of Developing an Infection	Amoxicillin: 1-2 grams, 1 hour preop with or without 500 mg postoperativey, tid or qid, 2-3 days	Odontogenic infections	1. No penicillin allergy Amoxicillin: 500 milligrams, tid, with or without loading dose of 1,000 mg, 3-7 d Amoxicillin/clavulanic acid: 500/125 mg, tid, 5 d Penicillin V potassium 500-600 mg, qid, 5-7 d
Infective Endocarditis Prophylaxis	1. No penicillin allergy Amoxicillin: 2 g, 30 minutes to 1 h preop Ampicillin: 2 g, IM or IV, 30 min to 1 h preop (if unable to take orally)		2. Penicillin allergy Metronidazole: 500 mg, bid or 200 mg, tid, 3-7 d Erythromycin: 250-500 mg, tid or qid, 3-7 d Clindamycin 300-450 mg, qid or loading dose of 600 mg followed by 300 mg qid or 150 mg, qid, 3-7 d Cephalexin: 500 mg, qid, 7 d Clarithromycin: 250 mg, bid, 7 d
	2. Penicillin allergy Cephalexin: 2 g, 30 min to 1 h preop Clindamycin: 600 mg (oral, IM, or IV), 30 min to 1 h preop Azithromycin: 500 mg, 30 min to 1 h precp Clarithromycin: 500 mg, 30 min to 1 h preop	Pericoronitis	Metronidazole: 200 mg, tid, 3 d
	Cefazolin 1 g, IM or IV, 30 min to 1 h precp	Sinusitis	Amoxicillin 500 mg, tid, 7 d Doxycycline: Loading dose of 200 mg, followed by 100 mg, once daily
		Acute necrotizing ulcerative gingivitis	Metronidazole: 200-500 mg, bid or tid, 3-7 d Amoxicillin: 500 mg, tid, 3 d
		Acute periodontal abscess	1. No penicillin allergy Amoxicillin: Loading dose of 1 g, followed by maintenance dose of 500 mg, tid, 3 d 2. Penicillin allergy Azithromycin: Loading dose of 1 g on day 1, followed by 500 mg once daily for days 2 and 3 Clindamycin: Loading dose of 600 mg on day 1, followed by 300 mg, qid, 3 d
Medically Compromised*	1. No penicillin allergy Amoxicillin: 2 g, 30 min to 1 h preop Ampicillin: 2 g, IM or IV, 30 min to 1 h preop (if unable to take orally)	Chronic or aggressive periodontitis	Amoxicillin (with or without clavulanic acid): 250-500 mg, tid, 8 d Tetracycline: 250 mg, qid, 6-30 d Minocycline: 100 mg, once daily of bid, 21 d Doxycycline: 100 mg immediately, followed by 100 mg qd or bid or 50 mg bid or tid 21 d Metronidazole (with or without amoxicillin): 250-500 mg, bid or tid, 7-8 d Clindamycin 300 mg, bid, tid, or qid, 8 d or 150 mg, qid, 10 d Ciprofloxacin: 500 mg, bid, 8d
	2. Penicillin allergy Cephalexin: 2 g, 30 min to 1 h preop Clindamycin 600 mg (oral, IM, or IV), 30 min to 1 h preop Azithromycin: 500 mg, 30 min to 1 h preop Clarithromycin: 500 mg, 30 min to 1 h precp Cefazolin 1 g, IM or IV, 30 min to 1 h preop		

Abbreviations: Preop, Preoperatively; qid, 4 times per day; tid, 3 times per day; bid, twice per day; IM, intramuscularly; IV, intravenously.
*Intravenous or intramuscular administration provided to patients unable to take oral medication.
(Courtesy of Stein K, Farmer J, Singhal S, et al: The use and misuse of antibiotics in dentistry: A scoping review. *J Am Dent Assoc* 149:869-884, 2018.)

infections. Combining it with a penicillin is an excellent choice, with coverage for both gram-positive and gram-negative organisms.

For patients who have a penicillin allergy, clindamycin was the most commonly used drug for prophylaxis, although azithromycin, clarithromycin, and erythromycin were also used. AHA guidelines do not include the use of erythromycin because it causes gastrointestinal upset and has complicated pharmacokinetics. However, dentists who had used it in the past often continued to prescribe it.

Dentists prescribed clindamycin therapeutically for patients with an allergy to penicillin, although they also occasionally prescribed

amoxicillin and macrolides. Usually erythromycin was a poor choice because many organisms are resistant to it. Study results showed that resistance to clindamycin is increasing, so drugs such as azithromycin and moxifloxacin may be appropriate alternatives.

The length of time patients were to take their antibiotics was usually 5 to 7 days, but dentists in several studies exceeded these durations. Little evidence exists to support a specific duration of treatment, but therapeutic antibiotics typically are used for 7 days or until 3-day symptom resolution. Seven- to 10-day therapeutic durations were used for patients who are immunosuppressed or have severe infections (Table).

Factors Influencing Prescribing Patterns

Most dentists acquired their prescribing knowledge from reputable sources, although some cited personal communication delivered verbally in an informal manner as their primary source of information. Prescribing behaviors changed throughout dentists' careers based on a number of factors. Included in these influencing factors were audits, education, and training. Because of the highly diverse and inconsistent characteristics of the dentists and their practices, no conclusions regarding specific practitioner characteristics in relation to prescription habits and knowledge could be drawn.

DISCUSSION

Dentists vary in their antibiotic prescribing behaviors, whether for prophylactic or therapeutic purposes. Often their patterns contradict the evidence currently available and the recommendations of professional organizations. Dentists are prone to influences such as patient pressure or medical provider pressure, as well as their own past prescribing behaviors.

Clinical Significance

Changes in dentists' inappropriate prescribing behaviors will require patience and perseverance. In addition to recognizing and implementing professional organizations' recommendations, dentists must use their clinical judgment and consider the type and site of any surgery done, the potential morbidity associated with infection, and the patient's general and systemic health. For patients who are immunocompromised, the dentist should consult the patients' medical care providers.

Stein K, Farmer J, Singhal S, et al: The use and misuse of antibiotics in dentistry: A scoping review. *J Am Dent Assoc* 149:869-884, 2018

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Guidelines for dental antibiotic prescriptions

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BACKGROUND

The emergence of resistant strains of bacteria to penicillins and other antibiotics has become a global public health problem. Dentists are part of the problem because they write between 3% and 11% of all antibiotics prescribed by health care professionals. Unfortunately, the awareness of both antibiotic resistance and its relationship to antibiotic prescribing by dentists remains low. Dentists need to become informed about the scope of the problem as well as factors that contribute to antibiotic resistance and are relevant to dentistry.

DENTAL ANTIBIOTIC USE

Infections of odontogenic origin usually require dental treatment, with the removal of the source of infection proving to be the most efficacious approach. Antibiotics are often added to this local treatment approach, often on an empirical basis rather than based on clinical indications. Penicillins are used more commonly than other antibiotics, but between 5% and 20% of bacteria commonly isolated from endodontic abscesses have demonstrated resistance to penicillins, and this number is increasing.

The bacteria found in orofacial odontogenic infections are mixed and can include both commensal and opportunistic organisms. These bacteria not only find safe harbor in the biofilm but can also develop internal mechanisms to resist antibiotic actions.

RESISTANCE

Resistance to antibiotics can be either intrinsic or acquired. Intrinsic resistance is a characteristic property of the microorganisms, making the entire species of bacteria resistant. Acquired resistance doesn't affect the entire species but just certain strains. It can be the result of chromosomal mutation or horizontal acquisition through gene transfer. This second mechanism allows resistant genes to be spread in different strains of the same species and between different bacterial species. Gene transfer can be achieved through transformation, transduction, or conjugation. In transformation, bacteria containing antibiotic-resistant genes