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Review Article

Pharmacotherapeutics in dentistry- A review

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ABSTRACT

The goal of health care services (Medical& Dental) around the world is to provide safe and effective health care to people when they are unwell. Accessible and safe primary care is essential to achieving universal health coverage and to supporting the United Nations Sustainable Development Goals, which prioritize healthy lives and promote well-being for all. Health services work hard to provide safe and high quality care, but sometimes people are inadvertently harmed. Unsafe health care in the form of under or over prescription of medicines has been recognized as a global challenge and research and clinical trials are in progress to understand the causes, consequences and potential solutions to this problem. Understanding the magnitude and nature of harm along with measures to reduce the harm is important because, every day, millions of people across the world utilise these health care services. Medications are offered by health services throughout the world that helps in increasing the quality of life and the overall life span of the individuals. However, with the prescription, comes a growing risk of harm especially with ageing population with increasingly complex medical needs and the introduction of many new medications.

Rationalised use of medications goes a long way in prompt and effective management, but unsafe usage can cause avoidable illness and injury, leading to unnecessary hospitalizations, and in some cases, disability and even death.

In many cases, prescriptions are given in the initial stages of management protocol. A substantial amount of literature about medication errors exists, but there are differences in the type of clinical problems encountered, classes of medications used and the organization of services in primary care. So the emphasis in health care settings should be towards institution of definitive treatment rather than the prophylactic medications unless the systemic status really warrants its use. The field of dentistry is one such area in which the medications are used as an adjunct for improving the prognosis of the therapy instituted. So there is a dire need of clear guidelines to provide definitive dental treatment to cure the problem rather than prophylactic medications per se. There are numerous guidelines issued by WHO & ADA for the same but the judicious utilisation and implementation of the same remains the treating surgeon's prerogative and totally depends on his judgement and experience.

The aim of this technical review is to provide an overview on key issues that can impact safety in the provision of medications. It negates the "one-size-fits-all" approach, and focuses on customised treatment protocol and medication regimen based on the clinical diagnosis giving due consideration to other variables such as age, gender and systemic status of an individual. The approach to improving safety in health care, therefore, needs to consider applicability in each country and care setting.

1. Introduction

The word "pharmacology" is derived from Greek φάρμακον, *pharmakon*, "drug, poison, (paranormal)—-λογία, *-logia* "study of", "knowledge of". Pharmacology is a branch of medicine and pharmaceutical sciences which is concerned with the study of drug or medication action, where a drug can be broadly or narrowly defined as any man-made, natural, or endogenous (from within the body) molecule

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which exerts a biochemical or physiological effect on the cell, tissue, organ, or organism (sometimes the word pharmacon is used as a term to encompass these endogenous and exogenous bioactive species). More specifically, it is the study of the interactions that occur between a living organism and chemicals that affect normal or abnormal biochemical function. If substances have medicinal properties, they are considered pharmaceuticals.[1]

Pharmacotherapeutics is the achievement of the desired therapeutic goal from the drug therapy. It is the clinical purpose and indication of giving a drug.

The two most cited oral health related reasons for a patient contacting an emergency department (ED) or the dental providers are dental pain and intraoral swelling.[2,3] These signs and symptoms are associated with pulpal and periapical conditions, which usually result from caries. Bacteria associated with caries can cause symptomatic irreversible pulpitis (SIP), an inflammation of the pulpal tissue. This condition may manifest as occasional sharp pain, usually stimulated by temperature change, and can worsen to spontaneous, constant, and dull or severe pain. Progressive pulp inflammation in the apical region (that is, symptomatic apical periodontitis [SAP]) may result in necrotic pulp (that is, pulp necrosis and symptomatic apical periodontitis [PN-SAP]). The infection can continue to move into and through the alveolar bone to the soft tissues surrounding the jaw (that is, localized acute apical abscess).

Depending on location and patient status, this can further develop into systemic infection (Table 1).[4,5] Dentists and physicians often prescribe antibiotics to relieve dental pain and intraoral swelling. General and specialty dentists are the third highest prescribers of antibiotics in all outpatient settings in the United States.[6] In addition, reports from 2017 through 2019 suggest that 30% through 85% of dental antibiotic prescriptions are "suboptimal or not indicated."[7–9].

Two major concerns with the medications are Drug resistance and over the counter medications.

1.1. Drug Resistance

Drug resistance is the reduction in effectiveness of a medication such as an antimicrobial or an antineoplastic in treating a disease or condition.

1.2. Over the counter medication (OTC)

It refers to the medicines sold directly to a consumer without a requirement for a prescription from a healthcare professional, as opposed to prescription drugs, which may be supplied only to consumers possessing a valid prescription.

To overcome these issues with the medications, the World Health Organization (WHO) implemented a global action plan to tackle the growing problem of resistance to antibiotics and other antimicrobial medicines at the Sixty-eighth World Health Assembly in May 2015. The theme of the campaign, "Antibiotics: Handle with Care," reflected the overarching message that antibiotics are a precious resource and physicians should exercise caution with their use.[10] Inappropriate and over prescription of antibiotics among dental practitioners is a major concern and have been identified as chief factors in the emergence of antibiotic-resistant microbial strains. Judicious use of antimicrobials by choosing the right drug, the standard dosage, and regimen for the appropriate duration should be a priority besides requesting for a culture and sensitivity test.

Evidence suggests that antibiotics for the target conditions may provide negligible benefits and probably contribute to large harms. The expert panel suggests that antibiotics for target conditions be used only when systemic involvement is present and that immediate DCDT should be prioritized in all cases.

As clinicians, it is also imperative for us to understand the concept of polypharmacy and its implications on oral and systemic health. Polypharmacy, the use of four or more medications by a patient, with co-existing diseases is most common in the elderly. It is often associated with a decreased quality of life, as a consequence of drug effects, interactions, and prescription cascade. Prescription cascade refers to the process whereby the side-effects of drugs are misdiagnosed as symptoms of another problem resulting in further prescriptions and further side-effects.

Elderly dental patients may present with complaints such as dry mouth, loss of taste, pigmentation or drug induced lichenoid lesions, and hyperplasias of the oral cavity. A thorough medical history and knowledge of the prescription they are following as well as regular reviews are recommended to determine the appropriateness of all medications.

Although a number of countries and clinical practice guideline development groups have produced recommendations on the use of systemic antibiotics to treat pulpal and periapical infections there are no guidelines from the American Dental Association (ADA) for dentists.[11–14] Based on the WHO directions, many national and international agencies, including the US federal government and Center for Disease Control and Prevention, have joined forces with the ADA to help prevent a postantibiotic era in which antibiotics will no longer be effective in treating bacterial infections.[15–19] The ADA Council on Scientific Affairs convened an expert panel of academic and clinical experts specializing in dentistry, medicine, and pharmacology to develop this guideline and its accompanying systematic review.[20] The ADA Center for Evidence-Based Dentistry (EBD) provided methodological support, and drafted manuscripts on the same.

Table 1: Pulpal and periapical target conditions and their clinical signs and symptoms

Target Condition	Characteristics of clinical signs and symptoms
Symptomatic Irreversible Pulpitis	Spontaneous pain that may linger with thermal changes owing to vital inflamed pulp that is incapable of healing
Symptomatic Apical Periodontitis	Pain with mastication, percussion, or palpation, with or without evidence of radiographic periapical pathosis, and without swelling
Pulp Necrosis and Symptomatic Apical Periodontitis	Nonvital pulp, with pain with mastication, percussion, or palpation, with or without evidence of radiographic periapical pathosis, and without swelling
Pulp Necrosis and Localized Acute Apical Abscess	Nonvital pulp, with spontaneous pain with or without mastication, percussion, or palpation; with formation of purulent material and localized swelling; and without evidence of fascial space or local lymph node involvement, fever, or malaise
Acute Apical Abscess with Systemic Involvement	Necrotic pulp with spontaneous pain, with or without mastication, percussion, or palpation, with formation of purulent material, swelling, evidence of fascial space or local lymph node involvement, fever, or malaise

Table 2: Recommendations as per the clinical situation based on availability of DCDT

S.No	Clinical situation	Recommendations	Remarks	Justification
1.	SIP with or without SAP (DCDT is not immediately available)	(a) No oral systemic antibiotics (strong recommendation, low certainty). (b) Refer patients for DCDT and provide interim monitoring	(a) Little to no difference in beneficial outcomes (low certainty), (b) Potentially large increase in harm outcomes (moderate certainty) (c) Strong recommendation **against their use**	Inflamed pulpal tissue associated with this condition is not due to an infection
2.	PN-SAP or PN-LAAA (DCDT is not immediately available)	(a) No oral systemic antibiotics (conditional recommendation, very low certainty). (b) Refer patients for DCDT and provide interim monitoring (c) If DCDT not possible- Oral amoxicillin (500 milligrams, tds, 3-7 d) or Oral penicillin V potassium (500 mg, Qid, 3-7 d)	(a) Little to no effect in beneficial outcomes (very low certainty) (b) Likely result in a large increase in harm outcomes (moderate certainty) (c) Conditional recommendation against antibiotic use	EDs, other health care settings, or rural settings, do not have access to oral health care
3.	PN-SAP or PN-LAAA (DCDT is immediately available)	(a) No oral systemic antibiotics (strong recommendation, very low certainty)	(a) Little to no effect in beneficial outcomes (very low certainty) (b) Potentially large increase in harm outcomes (moderate certainty) (c) Strong recommendation against antibiotic use	
4.	SIP with or without SAP (DCDT is immediately available)	(a) No oral systemic antibiotics (conditional recommendation, very low certainty)	a) Little to no effect in beneficial outcomes (very low certainty) (b) Likely result in a large increase in harm outcomes (moderate certainty) (c) Conditional recommendation against antibiotic use	(a) No antibiotics for SIP with or without SAP, especially those with the option of DCDT (b) Patients with pulp necrosis and acute apical abscess with systemic involvement Oral amoxicillin (500 milligrams, tds, 3-7 days) or Oral penicillin V potassium (500 mg, Qid, 3-7 d)

2. Scope, Purpose, and Target Audience

These guidelines focus primarily on Immunocompetent adult patients (18 years or older) with the target conditions and without additional comorbidities. Immunocompetent is defined as the ability of the body to mount an appropriate immune response to an infection. Immunocompromised patients do not meet the criteria for this recommendation, and they can include, but are not limited to, patients with HIV with an AIDS-defining opportunistic illness, cancer, organ or stem cell transplants, and autoimmune conditions on immunosuppressive drugs.[21–23]

The patients with co morbidities or other systemic illnesses require a different protocol. Although these recommendations are intended primarily for use by general dentists, they also may be used by specialty dentists, dental educators, emergency and primary care physicians, infectious disease specialists, physician assistants, nurse practitioners, pharmacists, and policy makers. These recommendations also might be discussed during chairside conversations with patients (Table 2)

2.1. Recommendations

The ADA expert panel suggests prescribing antibiotics for Immunocompetent adult patients (patients with an ability to respond to a bacterial challenge) with PN-LAAA in settings in which DCDT is not available. This recommendation is specific to situations in which the risk of experiencing systemic involvement is high and a patient may lack immediate access to care. The expert panel suggests not prescribing antibiotics for Immunocompetent adult patients with SIP with or without SAP, PN-SAP, or PN-LAAA in settings in which DCDT is available owning to potentially negligible benefits and likely large harms associated with their use.

The type of antibiotic chosen and its dosing regimen are dependent upon the severity of infection and the predominant type of causative bacteria. Amoxicillin is recommended for dental infections in doses ranging from 250 mg to 500 mg, every 8 hours[24]. The use of 3 g amoxicillin repeated after 8 hours is also mentioned, as a short course of oral therapy. Another antibiotic that is also recommended by the BNF is co-amoxiclav, which can be used in doses ranging from 375 mg to 625 mg every 8 hours.[25] In patients allergic to penicillin, clindamycin can be used in doses ranging from 150 mg to 450 mg every 6 hours.[26] Another option for penicillin-allergic patients (as recommended by the BNF) is metronidazole, which can be used in a dose of 200 mg every8 hours for 3–7 days. For severe odontogenic infections, higher doses of a broad-spectrum antibiotic may be required. Clindamycin is prescribed for patients who are allergic to penicillin as it is active against some oral anaerobes and acultative bacteria, and has the advantage of good bone penetration. Infections in which anaerobic bacteria are implicated (such as pericoronitis, periodontal abscess and necrotizing ulcerative gingivitis) are better treated with metronidazole; the best dosage regimen in terms of pharmacodynamic/ pharmacokinetic aspect is 250 mg every 8 hours.

3. Conclusion

The awareness of the recommended guidelines among dental practitioners can improve the prescribing practices of dentists. The universal guidelines of prescription can be of great benefit to the patients as well as it removes the chance of ambiguity regarding the indication and dosage of the prescription.

As Hippocrates stated “If you wish to become a physician always follow the maxim, first do no harm” let us all in the dental fraternity strive to make the lives of our patients more comfortable and at ease.

4. Abbreviation

ADA: American Dental Association.
CDC: Center for Disease Control and Prevention.
DCDT: Definitive, conservative dental treatment.
EBD: Evidence-based dentistry.
ED: Emergency department.
GPS: Good practice statements.
GRADE: Grading of Recommendations Assessment, Development and Evaluation.
PNLAAA: Pulp necrosis and localized acute apical abscess.
PNSAP: Pulp necrosis and symptomatic apical periodontitis.
SAP: Symptomatic apical periodontitis.
SIP: Symptomatic irreversible pulpitis.

5. Source of Funding

None.

6. Conflict of Interest

None.

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